THE JEWELRY REPAIRER'S HANDBOOK.

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PREFACE.

In preparing this hand-book it was not the intention to publish an exhaustive volume covering every detail of the whole field of jewelry repairing, nor a text-book for beginners. It is presented mainly for that large class of workmen who have learned their trade in stores and who desire to know the best as well as the latest methods employed in large jewelry repair shops. With this end in view the author has explained methods more fully than he otherwise would to workmen who have made the repairing of jewelry a specialty. J. G. K.

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THE BENCH

The jeweler's bench must be strong and well made and securely fastened to the floor to insure firmness. Its dimensions should be about 3 ft. 4 in. high, 2 ft. wide and 3 ft. long and the top 1¾ in. thick.

The bench usually contains two drawers; one—measuring from 21 to 24 in. long, 18 in. wide and 3 in. deep—immediately below the top of the bench, in which all tools are kept when not in use, and when closed it should be at least 3 inches back from the edge of the bench to allow the jeweler's hand perfect freedom while working at the bench pin; the other, or lap pan, from 21 to 24 in. long, 24 in. wide and 1¾ in. deep in front and having sloping sides which make the drawer 4½ in. deep at the back. This pan is lined with zinc, and when pulled out lies snugly in the jeweler's lap and catches all filings and scraps that fall from his work.

A very important part about the bench is the bench pin, and the writer has been considerably surprised to learn that very many jewelers have never heard of it. Into the edge of the top of the bench and above the middle of the lap pan, a hole is cut about

3 in. long, 2½ in. deep and ⅝ of an inch wide. Into this hole is fastened the bench pin—a flat piece of wood about 3 in. wide, ½ in. thick and extending 3 in. from the edge of the bench. Another style of pin with two surfaces—one flat and the other sloping —is used for filing rings. This style can be made to order or obtained from any material dealer.

On the bench pin most of the work is done, and it has aptly been called a third hand. Its further uses will be pointed out in the sequel.

TOOLS.

The beginner need not have many tools with which to begin work; indeed, for some time, in shops, he does not do anything but saw straight and curved lines in copper or brass plate. Then the tools required are a saw-frame and blades, a pair of flat pliers, a rule or straight-edge, a pair of dividers and a scribing point. As he advances he makes flat band rings of the strips, and for this work he requires a cut-off size gauge, one of which will be found on the top of every Allen ring-stick, a pair of shears, a pair of half-round pliers, a half-round file, a ring mandril, a rawhide mallet—small size—a blow-pipe, soldering block or charcoal, a borax slate and cake of borax, a small camel's-hair brush, a water-bottle, a pickle pan, a pickle cup and a soldering lamp, either alcohol or gas. Provided with these tools, the beginner is enabled to make up plain rings, and as he progresses he can do many repair jobs without requiring any more tools. But as these will be needed some time or other, below is presented a complete list of them, the use of each being briefly explained when considered necessary:

Alcohol lamp.
Alcohol cup.
Anvil.
Blow-pipe.
Borax-slate.
Burnishers { Regular. Spoon.
Camel's-hair brush.
Charcoal block.
Draw-plate.
Drawing tongs.
Files { Half-round. { Coarse and Fine. Flat. Barrette. Needle. { Knife-edge. Round. Square. Triangular.
Gravers.
Hand-vise.
Hammers { Large. Small.
Lamp.
Pendant bow contractor and ring bender.
Pliers { Rivet. Round. Half-round. Flat Parallel. Cutting. Pointed flat.
Pusher.
Pump-drill.
Punches.
Pin-vises.
Ring mandril.
Ring clamp.
Bench-brush.
Beading tools.
Borax.
Blow-pipe.
Drills.
Eyeglass.
Emery sticks.
Matting tools.
Magnet.
Oil-stones { Hard and Soft.
Saw-frame and blades.
Split tweezers.
Soldering-iron.
Setting mandril.
Testing-stone.

Ring size stick.
Rawhide mallet.
Scotch-hone.
Screw-drivers.
Sieve.
Shears.
Soldering lamp.
Spiral turners.
Testing needles.
Tweezers.
Vise.
Water-bottle.
Wax-box.
Wax-point.
Watchmakers' medium stiff brush.

The beading tools are tapering pieces of tempered steel, about four inches long, and have a concaved end which forms the beads or grains used when setting pearls. The tools are held in graver handles and are given a rolling motion.

Prepared borax can be bought at any material house, but crystallized borax, obtained in any drug store, will answer just as well.

The spoon-burnisher is made by softening and rounding and retempering the wide end of a flat file. This burnisher is used for removing dents, etc., from spoon bowls.

The small camel's-hair brush is used for placing the borax paste on the joint to be soldered. A larger one can be used for anti-oxidizing purposes.

Every jeweler should have a draw-plate with round holes and a pair of drawing tongs.

The matting tools are used to mat the solder which has run into the engraving or matting of band rings.

The magnet and sieve are used to remove dirt and steel, as well as iron, from the filings and scraps of gold.

The pendant bow contractor is used to bend very heavy rings which cannot be bent with the half-round pliers.

The rivet pliers are used to extract rivets from joints which resist all other methods. They are made from a pair of English hawkbill case-pliers by drilling a hole through the end of the flat jaw and

bending the curved end so that it will be exactly above the hole when the pliers are opened about a quarter of an inch. The curved part should be filed so as to go into the average joint without splitting it. It is not supposed to push the rivet out entirely, but simply to start it, after which it may be easily removed with a pair of pliers or a rivet punch.

The ring clamp or vise is a wooden arrangement for holding rings while stones are being set in them. It is a very useful tool and should be used by every jeweler.

A spiral turner is a piece of steel about three or four inches long and one-fourth of an inch in diameter. The one end is fastened into a long handle and the other is filed flat. Then a groove is cut across the middle about one-eighth of an inch deep and wide enough to allow the spiral wire to enter. Then to the side of the middle and about one-sixteenth of an inch from the top, a hole is drilled perpendicularly to the groove. A piece of wire is fitted into the hole, which will hold the spiral wire in position while being turned into a spiral.

The split tweezers have two broad ends, one of which is sawed in half lengthwise for about a quarter of an inch. This is opened to form a triangle. A narrow band, which fits around the other end, is moved back or forth when an article is inserted or taken out of the jaws. This tool is used mainly for holding scarf pins and button backs while soft-soldering.

The setting mandril is made by softening, smoothing and retempering a large rat-tail file. This tool is used for rounding up settings that are made of gallery.

The water-bottle should have a perforated cork and is used to drop water on the borax slate to grind the paste for soldering purposes.

The wax-box is an ordinary tin box half filled with wax which has been melted and allowed to cool. This box is used for keeping diamonds and other precious stones while on the work-bench.

The wax-point is a conical piece of ordinary bees-wax, the pointed end of which is used to pick up stones while setting them.

The pusher, used to push the prongs over stones, is a piece of soft steel about three-sixteenths of an inch square and about two inches long. It is fastened into a graver handle so that an inch or an inch and a half protrudes, according to the length of the handle used. The end which comes in contact with the prong is slightly beveled back and roughened, so that it will not easily slip.

The Scotch-hone or stone is very useful for removing scratches and file marks from articles to be polished, and especially so where engraving has been removed.

CHEMICALS, TABLES AND RECIPES.

The following is a complete list of chemicals a jobbing jeweler will need. Their uses will be pointed out as we proceed:

Alcohol { Grain or Wood,
Ammonia,
Aqua-regia (nitro-muriatic acid),
Benzine,
Bi-carbonate of soda,
Boric acid,
Calcium plaster,
Canada balsam,
Chloride of iron,
Chloride of zinc,
Chromic acid.
Gum mastic,
Muriatic acid,
Nitric acid,
Sal-ammoniac,
Saltpetre,
Shellac,
Sulphuric acid,
Sulphate of iron,
Sulphuret of potash,
Soap,
Washing soda.

Boric acid is used in the preparation of anti-oxidizer.

Chromic acid is used for testing silver. If a drop of it be placed on sterling silver it will immediately change its color from a bright crimson to a dark red, while on silver less than coin it will become the color of chocolate.

Muriatic acid is used in the preparation of soft-solder destroyer; for making aqua-regia, etc.

Nitric acid is used for testing gold and silver; removing mercury from gold and silver and for making aqua-regia.

Aqua-regia, which is an old name for nitro-muriatic acid, is composed of three parts of muriatic acid and one part of nitric acid. This acid or combination is used for dissolving gold and testing alloys of 14 karat or over.

Sulphuric acid is used for making the pickle which is used for cleaning articles after they have been heated.

It may be well to state here that should any acid, by accident, fly into the eyes of the workman he should immediately rub soap and water into the parts affected. We know this from experience to be an efficient antidote.

The uses of alcohol are so well known to the trade that it is not necessary to state anything about it excepting that wood alcohol, which is only one-half as expensive as grain alcohol, will answer just as well as the latter for the jewelry repairer's use.

Ammonia should be bought pure and diluted with four times its volume of water. This will be found satisfactory for washing jobs.

Bi-carbonate of soda, or baking soda, is used for washing dirty and slightly tarnished silver ware.

Benzine is used mainly for removing tripoli from work before using rouge.

Canada balsam, which can be obtained in any

drug store, is the cement used for cementing bifocal lenses.

Calcium plaster, or plaster of paris, is used for fastening tops on vinaigrettes, salt shakers, etc.

Chloride of zinc dissolved in alcohol is used as a soft-soldering fluid. It can be purchased at any drug store.

Chloride of iron is used for oxidizing brass buckles. The chloride is dissolved in water and then boiled. While boiling, the buckle is immersed until the desired shade is obtained. Should a darker shade be wanted, dip the article into a liver-of-sulphur solution.

Gum mastic is the best cement we know of for cementing pearls on pegs. It comes in "tears" or balls and hardens very quickly.

There are on the market jewelry soaps and washes of various descriptions, but for every-day use in the shop and store we prefer Ivory soap. It is smooth, does not scratch or cause the work to tarnish and is nice for cleaning the hands and face.

Shellac is used principally for fastening braid in the metal ends, for guards.

Sulphate of iron is used for precipitating gold held in solution and for making soft-solder destroyer.

Saltpetre is used as a flux for refining purposes.

A piece of sal-ammoniac is the handiest thing for tinning a soft-soldering iron. Moisten the sal-ammoniac with the soldering-fluid and then rub the heated iron and a piece of soft-solder over it.

Sulphuret of potash, or liver-of-sulphur is used for oxidizing articles of silver. It should be kept tightly corked in a bottle and can be used in either of two ways: Place a small piece in a boiling-cup and add some water, then slowly heat and immerse the article; or dissolve it in water and place it in a bottle to be used when wanted.

Washing soda is very useful for removing pickle

from hollow goods. Place the articles in a bowl of warm water and add washing soda until all bubbling ceases.

In all Government assay reports the proportion is given in fine gold and by thousandths. Thus thousandths reduced to karats equal:

1,000	or	24k.	.500	or	12k.
.958 1-3	"	23k.	.458 1-3	"	11k.
.916 2-3	"	22k.	.416 2-3	"	10k.
.875	"	21k.	.375	"	9k.
.833 1-3	"	20k.	.333 1-3	"	8k.
.791 2-3	"	19k.	.291 2-3	"	7k.
.750	"	18k.	.250	"	6k.
.708 1-3	"	17k.	.208 1-3	"	5k.
.666 2-3	"	16k.	.166 2-3	"	4k.
.625	"	15k.	.125	"	3k.
.583 1-3	"	14k.	.83 1-3	"	2k.
.541 2-3	"	13k.	.41 2-3	"	1k.

Coin gold is .900 fine, which is equivalent to 21 3-5k.

Silver coin, also, is .900 fine; while sterling silver is .925 fine.

Sterling silver is so called from the fact that the Easterlings—inhabitants of Eastern Germany in the 12th and 13th centuries—were noted for the purity of their alloys, and especially of their silver. Hence the name.

Troy Weight.

24 grains = 1 dwt.
20 dwts. = 1 oz.
12 oz. = 1 lb.

One cubic inch of pure gold weighs 8.4 oz.
One cubic inch of pure silver weighs 4.56 oz.

RECIPES.

Anti-oxidizer: There have been very many published recipes for anti-oxidizing solutions, chief of which was one consisting of ocher and borax. This preparation is alright but too dirty for the jobbing jeweler. The following recipes have been in use for years and found to be perfectly satisfactory:

A good anti-oxidizer is made by taking four ounces of rain water and putting in as much boric acid as will dissolve. Then add one-fourth ounce of pulverized borax. To apply, heat the article and when warm, paint it with a camel's-hair brush which has been dipped in the solution. This preparation is very good for engraved band rings and all articles which do not contain stones. But should it be desired to anti-oxidize an article containing stones, the following solution should be used: Take an ounce of alcohol—grain or wood—and put in as much boric acid as will dissolve. To apply, dip the article into the solution; remove and ignite, when it will burn off with a green flame and leave a thin, white, uniform coating upon the article to be repaired. Should a transparent anti-oxidizer be desired add ammonia, largely diluted with water, to the latter solution until it becomes perfectly clear. Before applying be sure to have the article perfectly clean. Paint it with a camel's-hair brush moistened with the liquid and place on a warm piece of charcoal to dry. When dry do not handle the article more than is absolutely necessary.

Blue Remover: Blue remover is made of equal parts of elixir of vitriol and muriatic acid.

Pickle: Pickle is prepared by mixing 1 part of sulphuric acid and 20 parts of water.

Oxidizing Solutions: No. 1: Place the article to be oxidized in a solution of liver of sulphur (sul-

phuret of potash) diluted with spirit of sal-ammoniac. No. 2: Saltpetre, 1 part; sal-ammonniac, 2 parts; sulphate of copper, 2 parts. These ingredients are reduced to a fine powder and dissolved in acetic acid. No. 3: Place a small piece of sulphuret of potash in a boiling cup and add about an ounce of water. Heat, but do not boil the mixture and immerse the article to be oxidized.

Lens Drilling Fluids: No. 1: Oil of camphor and sweet oil, equal parts. No. 2: Turpentine and oil of camphor, equal parts.

Soft-soldering Fluid: Soft-soldering fluid is generally made by dissolving small pieces of zinc in muriatic acid until all effervescence ceases; after which a small amount of sal-ammoniac is added. Another way to make this fluid is to dissolve a small amount of chloride of zinc in alcohol.

Soft-solder Destroyer: Many jewelers use nothing but muriatic acid to remove soft-solder from articles to be repaired but, in all our experience, we have not found anything to equal the formula of George E. Gee; therefore we give it in its entirety:

Proto-sulphate of iron.....	2 oz.
Nitrate of potassa.....	1 oz.
Water	10 oz.
	13 oz.

Reduce the proto-sulphate of iron (green copperas) and nitrate of potassa (saltpetre) to a fine powder, then add these ingredients to the water, and boil the preparation in a cast-iron saucepan for some time; afterwards allow the liquid to cool, and in doing so it will shoot into fine crystals; if any of the liquid should remain uncrystallized, pour it from the crystals and again heat it, when, on cooling a second time, it will all have become crystallized. The crystallized salt should then be taken and dissolved in

muriatic acid, in the proportion of 1 ounce of salt to 8 ounces of acid. Now take of the latter preparation 1 ounce, and add it to 4 ounces of boiling water in a pipkin, keeping up the heat by means already stated. In a short space of time the most obstinate cases of soft-solder will be cleanly and entirely removed and without the work changing color, if the instructions are properly carried out in preparing the mixture, etc.

Solution for Removing Cement from Work: A substitute for alcohol for removing cement from work is made of:

Rain water.....1 gallon
Lime .....2 pounds
Washing soda .....1 pound

Slack the lime in rain water. Then pour off the liquid and in it boil the washing soda for one hour. To use, place the articles to be cleaned in a boiling-cup and cover with the liquid, which is heated to the boiling point. Then rinse in water and dry.

A Good Silver Cleanser is made of the following:

Rain water .....11 oz.
Crystallized nitrate of silver..... 1 oz.
Cyanide of potassium .....2½ oz.
Powdered chalk ..... 5 oz.
Cream of tartar .....1-16 oz.
Table salt .....⅛ oz.

TESTING ACIDS.

The U. S. Mint Test for gold coin is composed of:

Strong nitric acid.....6½ drachms
Muriatic acid .....1-6 drachm
Pure water .....1 2-3 drachm

The U. S. Mint Test for silver is composed of:

Nitrate of silver.....24 grains
Nitric acid .....10 drops
Water ..... 1 ounce

If the coin is of base metal it will at once turn black.

For buying in old gold the jeweler will need two different kinds of acid—strong and weak, or more generally known as straw-colored and white. The straw-colored is the nitro-muriatic acid previously mentioned and the white acid is chemically pure nitric acid.

To test gold of any karat rub the article on the testing stone and the ends of two or more needles that are supposed to be nearly the same quality. Then apply the testing acid and the article will be of the same quality as the needle whose mark disappears at the same time.

Thus for testing 18k., rub the 18k. test on the stone and the article to be tried next to it. Then with the stopper put some of the straw-colored acid over both rubs at the same time. If the article tried is 18k. the acid will not affect it, but will withstand it the same as the test does; if not 18k. the acid will cause it to turn red.

From the description given for testing 18k. the reader can easily ascertain the quality of any other alloy. It should be borne in mind that the nitric or white acid should be used for testing gold-14k. fine or less. Always keep the testing stone and needles free from dirt and grease.

THE MAKING OF A RING.

The reader being acquainted with the tools and chemicals needed for the making and repairing of jewelry, we will now explain the methods employed in the making of a flat band ring which will illustrate many points in jewelry making.

The first thing to be considered is the gold. If old gold is used, we generally take gold of the karat desired, but when all the old gold is of a lower karat, we must add a certain amount of pure gold

to raise the old gold to the fineness desired. For instance, suppose we have a lot of 8k. spectacle frames which we desire to make up into 14k. rings. The gold spectacle frames must be thoroughly cleaned and all solder, rivets and screws removed, and then the gold is accurately weighed and the result noted; suppose it weighs 12 dwts. Then, by using the numeral 20 as a multiplier—which will always be constant, because it represents the number of pennyweights in an ounce—we determine the amount of fine gold to be added by the following example:

$$20 \times 14 = 280$$
$$20 \times 8 = 160$$
$$280 - 160 = 120$$
$$120 \div 10 = 12$$

Therefore, it is seen that to every ounce of 8k. gold must be added 12 dwts. of fine gold to raise it to 14k. Thus, in the example above cited, 7 1-5 dwts. of fine gold must be added to the 12 dwts. of 8k. gold to raise it to 14k.

The divisor, 10, of the example is the difference between the quality to be made and 24, which represents the number of karats; thus we see that the divisor will always represent the difference between the quality as improved by the addition of fine gold and 24.

If new gold or coin is used it must be reduced to the karat desired by adding to it copper and silver instead of fine gold, as in the former case. Suppose it is desired to reduce 12 dwts. of coin—which is nearly 22k. fine; 21 3-5 to be exact—to 14k. By using the number 20 as a multiplier, we find that

$$20 \times 22 = 440$$
$$20 \times 14 = 280$$
$$440 - 280 = 160$$
$$160 \div 14 = 11\ 3\text{-}7.$$

Therefore, we find that to every ounce of coin must

be added 11 3-7 dwts. of silver and copper in order to reduce it to 14k. gold.

In this case we desired to reduce 12 dwts. of coin and the amount of alloy to be added would be 6 6-7 dwts.

In reducing gold it will be noticed that the divisor always must be the karat of gold reduced.

The gold and required alloys being made ready, we proceed with the melting. This may be done in crucibles when there is a forge in the shop, but in many places the workman has nothing but his lamp, blowing-pipe and a piece of charcoal. Before placing the gold and alloys in the crucible, the latter should be rubbed well on the inside with charcoal to prevent the borax—which is used as a flux—and the gold from adhering to the sides and bottom. Then the crucible containing the metal is placed in the forge and the fire is started. The fuel generally used is gas, which is blown with great force by a blower connected with the forge. In some places charcoal forges are still used for melting purposes.

While the gold is melting, adjust the ingot mould to the width desired, and after slightly oiling it, place it near the forge to become heated just so the hand can touch it and not be burned. Then when the gold is thoroughly melted, which is known when it becomes perfectly clear on the top, it should be stirred well to mix the several alloys and then, while removing the crucible from the fire, a small piece of beeswax should be dropped onto the molten mass. This will exclude air and prevent oxidation.

The casting of gold into the ingot-mould is a delicate operation and requires a steady hand; otherwise the gold would be spilled around on the forge. After the gold is cast, it should be removed from the ingot-mould and cooled in water so that it may be readily handled. Then the edges and corners are filed and hammered to remove all small pieces which

would otherwise be lost while the bar or strip was being rolled.

But where the workman does not have these appliances and must do his melting on charcoal, he must proceed in a different manner. First, he should secure two large pieces of charcoal—we would suggest prepared charcoal, which can be obtained in blocks of the desired shape—and rub a flat surface on each. At the end of one of the flat surfaces should be cut a hole sufficiently large to receive the gold and alloys.

Now a mould or form should be made from a strip of sheet iron, about 6 inches long, and from 1-16 to ⅛ of inch wide. This should be bent with square corners to form an oblong mould whose ends should extend out to guide the molten mass into the form. This done, the workman should make 12 or more saw-cuts crosswise on the flat surface of each block and then place his form in position with the extended ends near the hollowed part, and then place the second piece of charcoal on top of the form and bind all together securely with strong binding wire.

All is now ready to melt and cast the gold. Place it and the alloys—which should be well mixed—and a small piece of borax into the hollow and blow a strong, steady flame onto the mass until it is thoroughly melted; at the same time agitate it constantly to insure its becoming thoroughly incorporated. When the molten mass begins to churn and becomes perfectly clear on the top it is ready to be cast.

This operation is as delicate as casting into an ingot-mould, and in many cases even more so. When satisfied that all is right, the charcoal-block should be tilted sufficiently to allow the mass to run into the form, and as soon as it is in the mould should be turned up perpendicularly and tapped

slightly with the blowpipe to settle the gold. Allow it to cool, cut the binding wire, remove the bar and trim and hammer as explained heretofore.

To melt gold in this way requires considerable practice with the blowpipe, so that one might blow a steady current of air through it, and at the same time breathe through the nostrils. Many jewelers cannot do this, but where practice is persisted in the result can be accomplished.

If the reader will close his mouth and fill his cheeks with air until they are distended, he will find that he can close the passage between the mouth and throat so that while he is breathing through the nose the cheeks will remain full. Then if a blowpipe is inserted and the passage closed the blowpipe will not permit the air to escape from the cheeks so rapidly but that the lungs may be filled by breathing through the nose, while the muscles of the cheeks are forcing the air out through the blowpipe. Then, when the lungs are filled the passage is opened and the cheeks refilled.

Now we are ready to roll or hammer the gold, which is done by passing it through two steel rollers which are pressed closer together by screws after each passage of the strip or bar. After being rolled several times, the gold becomes exceedingly hard and sometimes cracks. To prevent this the bar should be frequently annealed. After the strip is annealed, it is rolled or hammered to the desired thickness, after which it is annealed and boiled out in sulphuric acid pickle. To make a ring a strip of gold should be cut about three inches long and somewhat wider than the desired width of the ring to be made.

Suppose the ring is to be made size 8. On the top of every Allen ring gauge will be found a scale from 1 to 13. To make a ring size 8, the end of the strip of gold should be placed at the end of the

metal forming the gauge and then a line should be drawn across the strip of gold. Then at 8, on the top scale, draw a similar line across the strip and when the ring is made up—providing due care has been taken—it will measure 8 exactly. But broad rings should have an allowance of about one-half a size, when marking off the strips. In this case the strip would measure 8½ and when the ring was made up the reader would find the ring to measure 8 exactly. It is for this reason that clerks should notice whether they are using wide or narrow size rings when taking the size needed by a customer. In this connection it should be mentioned that in shops, the reading is taken at the lower edge of the ring and not in the middle, as is sometimes claimed.

After the strip of gold is marked to the desired size, take a pair of half-round pliers, or, if the ring is very heavy, take the pendant bow contractor and bend the strip into an ellipse. Then, with the saw or shears, cut off the surplus gold at the marks made on the strip. Now with a flat or barrette file, file the joints smooth and be very careful to keep them free from grease and dirt. This done, join the two ends with the pliers or bow contractor. Now mix up some borax paste and paint the joint well and lay on a small piece of solder. Many jewelers use solder made by taking the gold they are working and reducing it two karats. The reader can easily do this by following the instructions given for reducing a higher karat of gold to a lower. Instead of using all copper and silver a small amount of brass should be added to the alloy.

Cadmium solder is used a great deal, and this the jeweler can make by taking gold of any alloy and, after weighing, melt it. When in a perfectly liquid state, he should add one-fourth its weight of cadmium, stir the mixture well and pour very

quickly, as the cadmium is dissipated at so high a temperature.

The borax and solder having dried on the ring, lay the latter on a piece of charcoal and gently heat it, first on the opposite side of the joint, then the whole ring, until the solder melts and flows down through the entire joint. Allow the ring to cool, and then boil it out in the sulphuric acid pickle. If the gold is 10k. fine the color, after being boiled out, will be red, and the finer the gold the lighter will be the color. This is due to a lesser amount of copper in the alloys. After the ring is boiled out it is washed and dried. After this the solder is filed out nice and smooth on the inside of the ring with a fine half-round file. The ring is then ready to be rounded up. This is done by placing it on the mandril, which, in factories, rests on a gum tree block, and striking the ring on all sides with a rawhide mallet.

This operation requires considerable skill and practice, because the mandril must be held in the palm of the left hand and given a revolving motion, so that the mallet, which is held in the right hand, will strike all parts of the ring and make it perfectly round. Now, suppose the band ring was to be size 8 full and, after being rounded up, it measures 7¾. To make it size 8 full, we must use the steel hammer, and with careful, sharp blows, which must be given around the entire surface of the ring, we draw it up to the required size.

In sizing rings of this kind the writer prefers this method, because it leaves one joint only in the ring, and consequently the latter is not so liable to break while being worn. When the required size is obtained the sides of the ring are filed flat and smooth until the desired width is obtained. This done, the surface of the ring is filed flat and smooth, so that it may be easily polished. To file a ring of this

kind, hold it between the thumb and forefinger of the left hand with the ring resting against the bench pin. Then with a fine half-round file begin to file the surface flat and slightly hollow from the middle to the edge of the ring. To do this push the file from the body and at the same time give the ring a circular motion toward the body, and vice versa. Care should be taken to keep the ring the same thickness in all its parts. This seems to be a difficult matter for some ring makers—possibly apprentices—judging from the number of rings that we have seen that are thinner at the joints than anywhere else. This is due quite often to the fact that one end is rolled or pressed harder than the other, or the joint may not have been properly made and the jeweler filed away too much of the surface with the solder.

Engraved band rings are made in the same manner as the flat bands, excepting that the flat strip of gold is given its impression by rolling it in a small steel die, which makes the imprint in the strip.

Plain or half-round band rings are made in the same manner as flat bands, excepting that they are considerably thicker and are filed or turned half-round.

In ring shops plain rings are made by rolling long strips of gold through a pair of rolls, the lower one of which is grooved the desired shape of the ring.

The rings we have mentioned are now ready for the polisher, excepting the engraved band rings, which must have the green color removed. This is done by heating the ring to redness and plunging it into alcohol. We will describe the polishing of these rings under the head of "Polishing."

SPECTACLE AND EYEGLASS FRAME REPAIRING.

There is probably no more difficult job for the average jewelry repairer than that found in a broken spectacle frame, and especially so in one that has been broken and repaired near one place several times before.

If the reader will note where spectacle frames are generally broken, he will see that nearly two-thirds of all frames are broken on the left side, either in the nose piece, eye wire or side piece. This is due, no doubt, to the manner in which persons put on and remove the spectacles from their faces. Another fruitful source of breakage is the incorrect manner of holding spectacle frames while cleaning the lenses. Persons, as a rule, hold the frames by the nose piece while wiping the lenses. This is wrong, for by so doing the frame is given a severe strain which may cause it to break in the eye wire. The correct way to wipe the lenses is to hold the frame by the joints. This will relieve the frame of nearly all strain and reduce the possibility of breakage to a minimum.

Each time a spectacle frame is repaired it is polished and, consequently, it is made somewhat weaker, as all polishing cuts away more or less of the metal.

In repairing a spectacle frame the workman must leave it as strong, if not stronger, at the place where it had been broken, than it was before. This is an easy matter if due care be taken in soldering, filing and polishing. In illustration, we will take a 10-karat frame, which has been broken at any place in the frame—in this case, in the eye wire near the nose piece.

The first thing to be done is to secure a nice, flat piece of charcoal or any other kind of soldering block, and some sprigs, which can be made of binding wire and are used to hold the frame and broken ends in position on the soldering block. Then, these being in readiness, clean the broken edges with a file or scraper, and securely fasten the frame on the soldering block so that the broken edges meet but do not press tightly against each other; otherwise in soldering the frame the ends would unite and spring into a V-shape and cause considerable trouble. When the frame is secured on the soldering block, prepare the borax paste by placing several drops of water on the plate and rubbing the cake of borax in it until a thin paste is formed.

Then cut the solder and after moistening the joint with a camel's-hair brush, apply the solder with the moist end of the brush, or with a pair of tweezers. Then, with an easy flame, heat the solder and as little as possible of the frame on either side of the joint, until the solder flows. After the solder flows examine the joint to ascertain if it is perfectly united and, if so, remove the frame from the soldering block and pour heated pickle over the joint to remove the borax and fire-coat. But if the joint be not perfectly united re-borax and reheat the frame and cause the solder to flow. If not satisfactory this time remove the frame from the charcoal, clean it and proceed as before. It may be well to state that the repairer will not have much trouble in this direction if the manipulation of the flame is thoroughly understood and proper care is taken in regard to keeping the work clean. Be sure that there is no foreign matter in the water or on the borax slate which could get into the paste. It is also advisable that the fingers do not touch the parts to be joined, as

the grease and perspiration from one's fingers will prevent the solder flowing.

As stated before, in all spectacle repairing the workman should endeavor to leave the joint as strong and as neat as possible. To do this, the solder should be the very best obtainable, and in this connection we wish to state that no good repairer of spectacles or jewelry will use silver solder on gold work. This might be excused on work where it does not show and is gilded afterward. but even this should not be done. The solder should be placed on the outside of the eye wire, when the break is in the eye wire—and allowd to melt and flow through to the inside of the eye wire. In this manner the solder will flush the joint on the outside as well as in the inside. The surplus solder on the outside can easily be filed so that the place of the break will be thicker after it is repaired than the other part of the eye wire. Of course, a lump of solder should not be left large enough to attract attention. The solder which flows on the inside of the eye wire can easily be removed by cutting crosswise inside the eye wire with a flat graver, or lengthwise with a round graver similar in shape to an inside ring graver.

It is hardly necessary to describe the method of soldering different breaks in the spectacle frames, as one generally proceeds in the same manner in repairing all breaks, no matter where they may be. To the beginner we would state that he should not endeavor to do his work too rapidly, because he may then slight it, in which case he could not hope to become an expert at this work. As will be learned from actual experience, the method described for repairing the frames of spectacles is a good one for the average repairer who is not pushed with work. But for the man who does repair work for the trade this method is entirely too slow; therefore, he re-

sorts to a method which will not necessitate the pinning of the work onto a soldering block.

To illustrate the method of doing this work, we will take a pair of 10-karat spectacle frames that have been broken at the small bend in the nose piece. This is a somewhat difficult job to pin upon a soldering block, as the nose piece quite frequently is higher than the frame and consequently a groove must be cut into the block. But by holding the broken parts in the fingers the work is greatly simplified.

After removing the lens from the side nearest the break, the broken ends are filed or scraped nice and clean. Then the borax paste is ground up and the solder is cut into pieces of the desired size. Then the two ends are moistened with the borax paste and a piece of solder applied, either with the moist borax brush or with a pair of tweezers, to the end which will be above when the pieces are being held in position to be soldered together. In our experience we have found this to be the best way, for the solder will flow downward more readily than it will upward. And, again, in some cases solder can be drawn to its proper place if the repairer will so manipulate his flame and have the place to be soldered and the approach to it heated to the proper degree, which will attract the solder in that direction. This, however, requires considerable skill and experience and is not easy to master. When the joint is prepared and the solder placed in position on the upper end, place the blowpipe between the teeth and hold the two parts of the broken frame between the forefinger and thumb of each hand so that the edges will meet perfectly. To do this the hands and frame can be steadied considerably if the small fingers of each hand are extended so that they meet. Another way is to allow the small finger of the left hand to touch or rest against any convenient support, as the bench, vise, etc.

Then when the ends are in the right position, blow an easy, steady flame onto the edges, and heat as little on either side of the joint as possible—until the solder flows through and around the break. As soon as the solder flows stop blowing and pour pickle over the joint, which will remove the borax and fire coat. A pair of spectacles should never be allowed to lie in or be dipped into the pickle bath, as the acid will attack the steel rivets and screws and cause the gold to become coated very red. One can easily see that the latter method of soldering would be difficult for the beginner, but after some practice it can be mastered by any persevering workman. The reader also can see that this way of soldering is very rapid and useful for soldering the eye wire, no matter where broken; for soldering on broken off joints or end pieces, in which case the end piece is perfectly cleaned and the solder is laid on the eye wire, which has been moistened with the borax paste. Then the frame is held in the left hand and the end piece in a pair of tweezers is held in the right hand, and, with the blow pipe between the teeth, the work is easily and quickly done. Side pieces are held in the same manner to be repaired.

The question has often been raised as to the best way to repair broken side pieces. Some repairers place ferrules over the broken parts and solder with soft solder. This is a questionable practice and is condemned by every workman who takes pride in his work. Others claim that to file the ends off even and to solder, after which the solder is allowed to remain so that the break will be in the middle of the circular lump, is the best way. This is a very good way, but our experience has shown us that the best joint in side pieces is made by beveling each end so that the ends will over-lap and at the same time retain the thickness of the side piece. Then, after soldering, the surplus solder is filed off nicely,

so that it does not have a lumpy appearance. Of course, we do not mean to file the solder off entirely, but just sufficiently to make it an even swell and not an unsightly lump. The beginner should remove side pieces to repair them, but more advanced workmen can solder a break three-fourths of an inch or less from the end piece by holding the frame in his fingers.

All spectacle frames, whether gold, gold filled, silver, steel or alumnico, are soldered in the same manner as the gold frames. The steel and alumnico frames have the fire coat and borax removed by filing and scraping instead of being cleaned in pickle. The solder used on gold filled frames is the same as used on gold ones, but silver solder or fine brass wire is used for repairing steel spectacles. Alumnico frames are soldered with silver solder.

When the frame is repaired and cleaned with the pickle wash it with water and dry with a rag, which should be kept about the bench for that purpose. The frame is now ready to be trued and straightened—that is, the middle of the end pieces and the axes or centers of the lenses should be in a straight line, and the planes or top surfaces of the lenses should be in a straight line also. It is very important that the side pieces be similar in curve and shape as well as length, and when lying on a flat surface the curves should lie evenly upon it.

The cards which wholesale and manufacturing opticians issue for determining the pupillary distances of lenses are very useful as straight edges or guides for truing up the end pieces with the axes of the lenses. A simpler and quicker method for the jewelry repairer is to use a saw blade, securely fastened and taut in the saw frame, as a straight edge which can be laid on the top of the frame, and is more satisfactory than the method of laying the frame on the line of the card. The correctness of

the planes or top surfaces of the lenses can be determined by the eye, looking from one end piece to the other.

To slope the side pieces hold the frame by the end pieces—with the side pieces curving upward—between the thumb and forefinger of the left hand; and, starting near the end piece, move the fingers toward its extremity, with it between the thumb and forefinger of the right hand. Should it be desired to increase the curve move the forefinger slightly in advance of the thumb. To decrease the curve the thumb should be in advance.

Frameless spectacles are the most difficult ones to true up properly, because of their liability to break. Care should be taken that there is no strain on the glass anywhere, and especially at the straps which steady the glass. Before attempting to straighten frameless spectacles or eyeglasses see that the ends of the straps fit the edges of the lenses perfectly, so that the lenses will be firm. Then care should be taken that the screw will not draw upon the lens too tightly; if so, it should be taken out and the end of the strap bent slightly or the hole filed somewhat, and the screw again inserted. If this were not done the lens would be liable to break at any time.

Eyeglasses are usually broken in the spring or in the eye wire. These breaks are easily repaired by taking the frame apart and pinning the broken parts together on the charcoal soldering block. But if the spring is broken near the hole where it is attached to the stud, remove the eye frame and nose guard and prepare the joint as already described. It would be the safest plan for the repairer to pin the work onto the soldering block, but the quickest way is to hold the larger side between the fingers of the left hand and the smaller in a pair of tweezers, which are held in the right hand.

The instructions for repairing spectacle eye wire

apply to the repairing of the eye frames of eyeglasses.

There is no good way to repair rubber or zylonite eyeglass frames. Sometimes a hole is drilled on either side of the break and the ends drawn together with a piece of binding wire. A better plan is to put in a new eye. Springs are secured to rubber or zylonite eyeglass frames with pins, which are riveted.

If a gold or gold filled spring is broken at the screw hole, drill a hole in the end and replace it in the eyeglass frame and reshape it to suit the nose of the wearer.

New cork is easily placed in eyeglass guards by removing the old and slightly bending back the edge of the guard to receive the new piece of cork. Then the sides, or edges, are pressed over the cork, which is finished with a medium fine file. There is a narrow strip of metal beneath the cork of nose guards, in the end of which is a hole for the screw which secures the guard to the eye wire. Should this break, draw it out about one-fourth of an inch, drill a hole to insert the small screw and insert as before.

Shell or zylonite for guards can be bought in strips. From this the desired piece is cut and fastened to the nose guards with rivets.

The repairer occasionally will have trouble in removing screws from spectacle and eyeglass frames. Should the screw be rusted in the end piece or hold from any other cause, lay the end piece on a small anvil or block and lightly hammer the gold between the head and end of the screw. This will spread the gold around the screw and it can then be turned with ease if a good, strong screwdriver is used, which the repairman can grasp firmly in the hand.

If lenses are loose, either in eyeglass or spectacle frames, file away a very little of the gold or metal

between the joint or sides of the end pieces, so that the parts can be screwed closer together. This failing, move the joint back on the eye wire. The careful workman will not countenance the practice of putting sheet lead or tinfoil between the lens and eye wire to tighten the glass. Great care should be exercised in filing between the joints or end pieces, either to tighten the lens or the side piece. In the latter case it would be better to use washers or to put in new rivets. Some workmen have an idea that side pieces can be tightened by laying the joint on an anvil and hammering the rivet. This is a mistake, because the gold is stretched more than the rivet is compressed and, consequently, the side piece will be as loose as before, or, if tighter, will work itself loose in a very short time.

But if one wishes to tighten the side piece without putting in washers or rivets, lay the end on an anvil and strike the rivet several sharp blows with a punch of the same diameter as that of the rivet. This will compress the rivet and tighten the side piece without any injury to the gold joint.

If lenses are too large for the spectacle or eyeglass frame and a grinding stone is not at hand, use a slightly coarse, flat file, wetted with water, for reducing the size. In filing move the file toward the lens at an angle of about 45 degrees.

The jeweler is often called upon to drill a hole in an eyeglass lens for a cord. This is an easy matter if one has a lens drilling machine, but if not the case is different. Secure a large, three-cornered file and grind the three sides smooth and to a point, and sharpen on the Arkansas stone. Moisten the lens with the lens drilling mixture—sewing machine oil will answer nicely—and make a small mark on the lens where the hole is to be. Then place the lens against the edge of the bench or any other firm place, insert the three cornered point, which is given

a rotary motion back and forth. After drilling about one-half way through, turn the lens and proceed in the same manner from the opposite side. A three cornered drill used in the pump drill will do this work nicely. In using lay the lens on a large, flat piece of cork and use the drilling fluid freely. When a small opening is made moisten a fine rat-tail file with the drilling mixture and broach out the opening to the size desired.

CLEANING BIFOCAL LENSES.

There are many forms of bifocal lenses, from the "split" glasses, invented by Benjamin Franklin and, consequently, so named, down to the present cement bifocal.

The dirt which accumulates between the former form of bifocal lenses is easily removed by taking the glasses from the eye frames and wiping them with tissue paper. The cement bifocal, which is very popular at present, is very neat, but it has several serious drawbacks. In wiping these lenses great care must be taken that the heat and friction do not cause the segments to become loosened from the distance glasses or the space between will be obscured by vapor bubbles. Another drawback is the fact that a sudden jar is liable to cause"Newton's rings," a beautiful iridescent phenomena, which present all the colors of the rainbow when the glass is held in a favorable position.

To clean these lenses it is necessary to remove the dirty or spotted cement which unites the two parts of the lens and reunite them with new cement—Canada balsam. Many prefer to use the cement prepared by optical companies. Canada balsam, however, is the nicest form, as it is put up into tubes and a drop can easily be pressed out whenever wanted. In

cleaning lenses of this description it is necessary to take the lens from the eye frame and to remove the segment from the larger glass by slightly heating the latter on the side opposite the segment. Both pieces are allowed to cool, after which they are cleaned with alcohol and wiped perfectly clean and dry with a soft rag or tissue paper.

The large glass is then held in a pair of tweezers and a drop of the cement is placed on it. This is heated over a small alcohol flame—but not allowed to ignite—until a vapor is given off, at which time the segment should be applied to its proper position and pressure given to force all bubbles from between the two glasses. If, however, spots or bubbles remain, remove the segment and, after cleaning both glasses, repeat the operation. The cement, after heating, becomes hardened in a very short time and can be chipped off with a graver or scraper. The residue is removed by the use of alcohol and a medium stiff brush.

JEWELRY REPAIRING.

There is nothing, aside from personal attributes, which more easily makes or mars a jeweler's reputation or affects his trade than the character of his repair work. It is not more difficult to do a job nicely than it is to "botch" it, if care and judgment are exercised in the work. To become expert at jewelry repairing the workman should be able to see at a glance exactly what is necessary to be done in each job and then do that in the best and quickest manner possible.

Many jobs in themselves are not worth the repairing, but the owners prize the articles, for the sake of associations, of which the repairer knows nothing, and for this reason, as well as for his reputation, the jeweler should not slight the meanest job.

Replacing a Pin Tongue.—Replacing a broken pin tongue in a brooch is considered an easy matter and so it is if the work is done in the right manner. In many cases the pin tongue is broken off at the joint. The first thing, then, to be done is to remove the rivet from the joint. This may be pushed out with the tweezers or any other point, and if it does not yield to this treatment use the rivet pliers. The rivet removed, select a pin tongue whose joint is about the same size as that of the joint on the brooch and cut it to fit into the joint. Then hold the brooch with the top side down and in this posi-

tion the catch will be nearest the body of the workman. Then, with the right hand insert a round broach—the round ones are the best, as they stretch the stock instead of cutting it—into the joint and through the pin tongue joint until the end appears on the left side of the joint. Then care must be taken that the pin tongue will move up and down on the broach—which serves as the rivet—without causing the latter to move. When this is satisfactory, remove the broach and, if necessary, cut the pin tongue to the required length and repoint it. This is done by placing the tongue in a small pin vise and laying it in a groove on the bench pin and giving it a rotary motion between the thumb and forefinger of the left hand, while a fine file is passed back and forth over it with the right hand. This done, the rivet is filed in the same manner, excepting that the taper is not so acute, and inserted from the right, always; and when the pin tongue will work nicely—not too tightly or too loosely—without causing the rivet wire to move, cut off the ends close to the joint with a pair of cutting pliers or a saw and file them off smoothly, but not quite even with the joint. Then finish by hammering it lightly on each end, so as to prevent any possibility of its working out.

To remove a rivet that has been inserted in this way hold the brooch so that the catch will be farthest from the body and file the right side of the rivet and then force it with the pliers. All rivets in new work, as brooches, lockets, match safes, watch cases, etc., are inserted from the right, and when this is fully understood the repairer will not have much trouble in removing rivets.

To Make a Pin Stem.—Pin stems having regular joints are made as follows: Take a piece of hollow wire and file small grooves crosswise on the seam,

and lay this on a thin, narrow piece of stock and, after binding the two securely together with the binding wire, coat the line of contact with borax paste and on this lay small pieces of solder. Then, when the borax has dried, apply the flame until the solder flows and unites the two pieces. The binding wire is then removed and the stock "boiled out" in the sulphuric acid pickle. Then cut the flat stock off to within one-sixteenth of an inch of the hollow wire and the stock is placed on a flat piece of charcoal, with the hollow wire beneath. The pins, which have been pointed, are arranged with the butt ends on the plate and with sufficient distance between to allow for cutting, etc., and fastened there by sprigs made of binding wire or by mixing plaster of paris and water and pouring the mixture onto the ends of the pins. This, when dry, will hold the tongues in position, while the butt or thicker ends are being soldered to the joint stock. After all soldering is done remove the sprigs or plaster of paris and clean the work in the sulphuric acid pickle. The pins may then be separated as they are wanted.

Pin stems for ball joints are made by drawing the wire to the thickness of the pin desired and cutting it about one-eighth of an inch longer than necessary. The end is then melted into a ball, which, when hammered, will spread sufficiently to allow the drilling of a hole through it and, at the same time, serve as a spring.

To Straighten Pins.—Very often it is necessary to make pin tongues and scarf pins in bulk, and it is necessary to have the wire perfectly straight. This may be accomplished by annealing the wire after it is drawn to nearly the required thickness and fastening one end in a vise, while the other is secured in a drawing tongs and the wire stretched as much as possible without breaking it. When re-

heved of the strain the wire will be found to be perfectly straight.

Repairing Broken Scarf Pins.—Broken scarf pins are repaired by beveling each end of the break so that when joined the ends will overlap but not be any thicker than the other parts of the pin. To solder breaks of this kind—which usually occur about the middle of the pin—the set should be wrapped in wet tissue paper before the parts are fastened on the charcoal soldering block or held in the fingers to be soldered. To solder the pin in the fingers, grasp the ball of moistened tissue paper which envelops the set, between the thumb and forefinger of the left hand, and with a pair of tweezers in the right hand place and hold the other end of the pin in position. When scarf pins are broken off at the setting it is advisable to remove most of the stones before soldering is attempted. Doublets, sometimes, will stand the heating and at other times they will not.

Pearls, genuine turquoise, amethysts, the topaz, opals, etc., must be taken out or they will be ruined. Small doublets and diamonds will, in most cases, stand the heat necessary for soldering, but it is advisable for the repairer to take as little risk as possible, and especially so with diamonds. After the stone is removed from the setting, the parts to be soldered are cleaned with a file or scraper.

The setting, with the filed part upward, is then fastened on a piece of charcoal and the filed end of the pin placed in its proper position. To do this, insert the point of the pin into a small piece of charcoal and lay both on the large soldering block, so that the two parts to be joined will be in their respective positions. Then apply the borax paste, solder and proceed as before.

Enameled pins, whether school, scarf or brooch pins, are difficult to repair without melting or chip-

ping the enamel. The safest plan is to explain to the customer the risk that is taken and what the consequences might be. Then proceed to prepare the joint in the usual manner.

A piece of mica—which may be obtained at any drug or stove store—is laid on the charcoal soldering block and on this is laid the piece to be heated. In this way the enamel, while heated, will not become black or dirty from the soldering block. After the article is soldered, allow it to cool before attempting to remove it from the mica; otherwise the enamel will chip out. This is not a very good method for curved enamel surfaces, but it is the best known at present. Heated enamel or stones should not be immersed in pickle or water until cold, lest they crack.

Twists in Pintongs.—Pintongs having twists in the middle are made by drawing the wire to the desired thickness and hammering it slightly flat in its middle portion, after which it is annealed, and then by holding the ends of the flat surface in hand vises or pliers, twisting the wire four or five times. Anneal again and draw the pin, twist and all, through the hole in which the wire was last drawn. This will smooth the twist and the pin is ready to be made up.

Repairing Set Rings.—Set rings broken at the joint are the easiest to repair, as all that is necessary to be done is to file the broken ends even and to join them so that they meet nicely, without any pressure and with the same curvature of the ring. A joint of this kind will solder nicely, but where the ends meet with pressure, they will, when heated, spring into a V-shape and cause considerable trouble. Having joined the broken ends, take a piece of tissue paper and fold it until it is about one-half an

inch wide and from three to six inches long, according to the size of the set to be protected. This is saturated with water and wrapped around the set, after which the joint is coated with borax paste and a small piece of solder applied. To solder the joint, thus prepared, hold the set between the thumb and forefinger of the left hand and blow a strong flame onto the joint, and somewhat on either side of it, until the solder flows. As soon as this is done, dip the soldered part into pickle and rinse it in clean water. The tissue paper is then removed and the surplus solder filed from the inside of the ring with a fine half-round file. Then the ring is placed on a mandril and "rounded up." This done, its sides and surface are filed even and smooth with a fine file, and the stones securely fastened so that they will not be lost while the ring is being polished or worn.

To Repair Rings Broken at the Set.—Before anything is done on a job of this kind the stones should be removed from the setting. This is done by placing a knife blade between the prong and stone and gently pressing upward. This will loosen the stone, which can then easily be pushed out. Pearls, turquoise, etc., are removed by cutting away one or more beads by which they are held in position and then lifting out by pressing a wax point down on them and quickly jerking it upward. The foil-backs of a marquise ring quite often can be forced out by pushing them from the back with a blunt pin or pusher. Cameos, intaglios and all stones having beveled edges, over which the gold is burnished, are removed from the settings by cementing the top of the stone on a cement stick. When the cement has hardened the ring can be pried from the stone, which will remain imbedded in the cement. If, however, any difficulty is encountered in this method, strike the extreme outer edge of the setting

with a hammer before fastening the stone on the cement stick. By removing these stones in this manner the edge of the setting will be preserved intact and the stone can easily be sprung back into its former position and the gold burnished over it.

When the stones are removed anti-oxidize the setting and prepare the joints in the usual manner. Then apply the borax paste, a small piece or more of solder and lay the ring on a piece of charcoal and heat it gently—care, however, being taken with settings having prongs, so that the ends are not melted —until the solder flows. Then the ring is cleaned in pickle, the surplus solder removed and the ring rounded up and smoothed in all its parts. Set rings may have the inside of the setting polished or gilded, as the workman may elect. The latter method usually is the one adopted where there are several settings in a cluster.

Tiffany, belcher and rings of this description, no matter how many settings there may be, always have the inside of the setting polished. The gilding of the settings is done to give a nice finish to the interior, nothing more. The prongs and outside of the settings are polished in the usual manner. Then after the settings are washed and dried the stones are replaced in their proper positions and the ring is ready for the final polishing. This method of repairing set rings, no matter where broken, is difficult for men who do not have much of it to do, but without a doubt it is the only proper way of mending rings of this kind. We have seen rings, one particularly with an opal center and half pearls surrounding it, which was broken at the set, and the workman had taken a thin piece of gold and soft-soldered it inside the ring so as to join the two ends. Then he had drilled four holes, two on each side of the break, which he tapped and in these he inserted screws—a very ingenious method of doing the work,

and, from the way it was done, we think the man was capable of better things.

New Prongs on Settings.—Occasionally it is necessary to replace one or more prongs on a ring setting. Sometimes the prong can be stretched by laying it on the anvil point or by means of a pair of pliers. In either case it would be well to anneal the prong to prevent it from breaking. If it cannot be repaired in this way, remove the destructible sets and take a thin piece of gold of about the same width as the prong and bend it double, allowing the bent portions to touch. This done, bevel one end, also the inside of the prong. Then, after anti-oxidizing the setting, slip the double piece of gold over the prong and, after boraxing the joint, lay a piece of solder on the inside and blow an easy, steady flame on the setting until the solder flows. After the solder has united the two parts the ring may be cleaned in the pickle and the unattached piece of gold can be removed, as it has served its purpose. It may be well to state that the double piece of gold should not clasp the prong too tightly as in this case it would spring off when heated. Another method of doing this is to prepare the prong as in the former method and afterward anti-oxidize the setting. The end of the prong is boraxed and a piece of solder laid upon it. Then a small piece of gold of the width and thickness of the prong is taken and one end is beveled to correspond to the end of the prong. To join the two prepared ends hold the ring in the left hand and the small piece of gold between a pair of tweezers in the right hand. Blow an easy, steady flame onto the solder, and, when about to melt, join the two ends and heat so that the solder will unite both firmly together. Afterward the new part can be cut and filed to correspond to the other prongs in the setting. This

method is very well for cluster rings, but for Tiffany mountings it makes a nicer job to put on an entirely new crown or setting. Secure a setting which will take the stone nicely—the girdle of the stone, when laid on the top of the setting, should cover about one-half of the top of each prong—cut out the old setting and fit in the new one. Considerable care must be exercised so as get the new setting perfectly straight. Another way to re-crown a Tiffany ring is to cut off the top horizontally and solder the setting on the top. This way is the easier, but the former is the better. After the setting is soldered in position, file the ring so that it is uniform on all sides, after which the scallops can be cut to the required depth. After polishing, inside and outside, the stone is ready to be reset. The subjects of polishing and setting will be considered later.

For the benefit of those who want to take the risk on Tiffany, or for that matter, on any other mountings, we will describe how some workmen replace one or more broken prongs. Suppose two prongs are worn off the setting which holds a diamond of a karat weight. These workmen will make a saw-cut from the girdle of the stone downward along its lower side. Then they will cut a piece of gold V-shaped to fit over the girdle of the stone, the same as a prong would do, and fashion the lower part to be pushed down into the saw-cut until the top part rests snugly on the top slope of the stone. The setting was previously anti-oxidized and now the joint is boraxed and a small pallion of solder applied. Then an easy flame is directed upon the joint until the solder flows, which unites the two parts. But simple as this may appear the risk is very great, for the least draught of air might crack the stone and the loss would be many times the value of the time it would have

taken to remove the stone and to have done the job in the regular manner.

Repairing Broken Band Rings.—Band rings having one break are easily repaired by scraping the joint clean and then joining the two ends without any pressure, with the same curvature as that of the ring. When this is done, anti-oxidize the entire ring and paint the joint with the borax paste. Lay a piece of solder on the inside of the ring. Then the ring is laid on the charcoal soldering-block and the ring soldered as previously described. But where two or more breaks are to be repaired in one ring, we must proceed in a different manner. Scrape the joints clean and see that all have the same degree of curvature. Then place the largest piece on the ring stick and fit the next largest piece where it naturally belongs. By placing the small end of the ring stick against the bench and the butt end against the body, both hands can be used to place the third piece in position and to bind the three together with a double piece of binding wire. The ends of the wire should be brought together and twisted, but not too tightly, otherwise the pieces would spring out of place. A little practice will enable anyone to do this work without much trouble. After the pieces are securely bound in position by the binding wire, anti-oxidize the whole and paint the joints with borax paste, and lay a piece of solder, inside the ring, on each break. Then blow an easy, steady flame on all parts of the ring until the solder flows and firmly unites all parts. After "boiling out" the ring in the pickle, remove the solder from the inside of the ring with a fine half-round file and round it up. This done, file the sides smooth and even and replace the ring on the mandril and matt the joints with a fine matting tool. Solder, which has flowed onto the outside, may be finished in the same way.

Sizing Rings.—To make a ring smaller it is necessary to note what the size of the ring is and what it is to be. For instance, we have a Tiffany ring, size eight, which is to be made size five. We take the pair of dividers and measure three sizes on the scale near the end of Allen's ring stick. The length of the three sizes we will mark on the bottom of the ring with each point of the dividers. Then this piece may be cut out with either a pair of cutting pliers or with the saw. The joint is then prepared and the soldering proceeded with as has been described for set rings; but in sizing a ring of this kind, the amount of gold taken out and the consequent bending have caused the setting to stretch and the stone to become loosened. This should be tightened by pressing the prongs tightly upon the stone with the pusher. In making rings larger, take the measure in the same manner as in the case just described. But to put in the extra piece of gold is a rather difficult job. In enlarging band rings the new piece can be curved and placed in position on the ring stick, where it is secured by passing doubled binding wire around the entire ring. We can hardly remember an easy way of putting pieces in other rings; however, the rings can be "pinned up" on charcoal after the sets have been duly protected. In repair shops the workman will open the ring where it has been cut and leave the one end higher than the other. These are then filed so as to make a good joint. A piece of gold is then taken which is about the same width and thickness as the shank of the ring, and given the curvature of the ring. Then, after wrapping moist tissue paper around the stones, the workman takes the set between the thumb and forefinger of the left hand and paints the joint with the borax paste and applies a small piece of solder. Then he places his blow-pipe between his teeth, takes the new piece

of gold between his tweezers, dips the filed end into the borax paste, joins the two and blows a strong, steady flame onto the joint and somewhat on either side of it until the solder flows and unites the two pieces. Then on the new piece he marks off the number of sizes to be added, cuts off the surplus gold and prepares the end as before described. This done, he joins the edges and proceeds in the method described for repairing a set ring broken at the joint. When the last joint is soldered the ring is allowed to cool before it is cleaned in the sulphuric acid pickle. Then the inside is filed smooth with the half-round file and the ring rounded up. If the ring does not reach the desired size after it is rounded up, hammer the ring shank evenly until the size is obtained. Then finish the new piece to conform to the other parts of the shank. Where rings are to be made from one-quarter to three-quarters of a size larger, it is often desirable to stretch them by means of hammering, while on the mandril. This is preferable to having two joints very close together.

New Shanks on Rings.—Very often it is necessary to put an entire new shank on a ring to make it serviceable. To do this nicely secure a piece of gold, the width and thickness of the shank, on a new ring of a similar pattern. The thickness generally is 150 on a screw-gauge, which is equivalent to 2-3 millimeter. When this is obtained, cut off the old shank where the new piece is to be joined and prepare the joints as previously described. Then bend the new piece to conform to the curvature of the ring and cut it the required size. Place the shank and setting on the ring stick and tie the two together with binding wire. Before soldering, in a set ring, the setting should be anti-oxidized to protect the color of the gold. When the parts are sol-

dered, clean the ring in pickle and finish it in the manner described for sizing rings.

New Gallery Settings.—If the setting for a large cushion stone is badly worn, it is advisable to replace it with an entirely new setting in preference to restoring the old claws. This is easily done by securing gallery stock, which may easily be bent to the desired shape and size. This gallery is illustrated in most material catalogues and the repairer can easily determine the size and amount required. It is usually bought by the foot. After the setting is bent to the required size and shape, the ends are joined and, after cleaning, it is ready to be soldered in position. This is done by the same method, previously described, for holding the ring shanks to be soldered.

Lining Band Rings.—Band rings, which are worn very thin and are considerably cracked and broken, may be made serviceable and strong by lining them. Take a strip of gold somewhat wider than the ring, and make the inside ring the same size as the one to be repaired. Then place the broken band over the newly made ring and measure the size of the piece necessary to be placed in the upper ring to fill the gap between the two edges. When this is done, secure all together by means of binding wire and anti-oxidize the engraved surface. Then lay small pieces of solder around the edges, one side at a time, and when the borax has sufficiently dried to prevent it from throwing off the solder, blow an easy flame onto the interstice. When one side is soldered, remove the binding wire and clean the ring by boiling it in the sulphuric acid pickle, and wash in water. Then re-tie the ring and, after anti-oxidizing the engraved surface, proceed as before. When all soldering is done, remove the binding

wire, clean the ring and round it up. The sides are then filed to the edges of the band ring and, finally, the top surface is finished with a fine file or an emery stick.

Repairing Initial Rings.—Initial rings are nearly always broken at the box or setting, or at the bottom. Those broken at the bottom are easy to repair, but those cracked at the set require more time and patience. Carefully remove the rivets or screws holding the initial, after which the stone, generally onyx, is easily raised. Initials fastened in position with a screw at the bottom cause much trouble if the screw-head becomes rusted. Should this be the case, grasp the initial firmly with a pair of pointed pliers and unscrew in that manner. This will not injure in the least the initial or screw, but usually a new screw should be inserted. Then clean the parts to be united and join, but avoid any pressure as the joint would spring into the V-shape when heated. If the shank is sawed or cut so that several ends touch the setting, see that all are joined nicely, then borax and solder all at the same time. It is not necessary to tie binding wire around a job of this kind unless the shank is broken off the box on both sides. If so, place the shank on the ring stick and insert the setting and secure with the iron wire. Care, however, must be exercised that too great pressure be not given, lest the ends slip up on the setting about the time that the solder flows.

Frequently the underside of the box is cracked or dented. This is a difficult place to repair nicely, as the edge of the gold is liable to melt when heated. There have come to our notice many rings of this kind which have been repaired with silver solder and, consequently, show a white line. The best way to repair these rings is to solder a thin, narrow strip of gold over the break. In this way the gold will

cover the crack and fill it as the solder flows to the piece of gold. If the solder were laid over the crack, when melted, it would flow to either side and a piece of gold would have to be placed over the crack to draw it back. After the solder flows and the gap is not closed entirely on the inside, place several pieces of solder where needed and melt. Then, after cleaning the ring in the sulphuric acid pickle, remove the surplus gold and solder and, if necessary, round up the ring. When filing do not use the point of the file to remove marks or solder, as this does not better the work in the least. File with the full surface of the file and the polishing process will be considerably easier and, at the same time, will leave the repaired article in a better state.

Braid or Hair Chains to Repair.—The attachments of braid or hair chains are made in two parts and, in most cases, are soft soldered together. When broken, the surface should be scraped or filed clean and moistened with soft-soldering fluid. The parts are, while being soldered, held in the split tweezers over an alcohol flame. If the braid or hair is badly worn and it is desired to put in new silk, tie a piece of binding wire around each attachment before heating it, preventing thereby its becoming unsoldered. All attachments should be cleaned and polished before the braid is inserted.

To Repair Cuff Buttons.—Lever back cuff buttons are the most difficult to repair, because, usually, the break is in the under part containing the spring, which must be removed. But, if the button is broken anywhere else, the spring must be removed before any hard soldering can be done. This is accomplished by cementing the back on a cement stick and taking up the edge with a knife or graver. When the button is repaired, the back should be

held on the cement stick while replacing the spring. The edge can be bent over with the pusher or hammered over with a square punch. There are some buttons on the market the backs of which work on a rivet, and these will not give the repairer any trouble. Link and one-piece buttons are not difficult to repair, but it is advisable to leave as much solder as possible on the joints to insure strength.

To Repair Buckles.—Cut steel buckles have the attachments fastened with soft solder, and when these become loosened the break should be scraped and moistened with the soldering fluid. Then the parts are easily soldered by holding them together with the split tweezers over an alcohol flame. Buckles of this kind are cleaned by brushing thoroughly with a brush with a plentiful use of tripoli or Vienna lime. Putz-pomade can also be used to advantage. It is hardly necessary to describe the method of repairing any of the other cheap buckles, excepting that all marks of soft soldering should be covered, either by gilding or gold paint.

Bracelets to Repair.—Spring bracelets, broken in the middle, are repaired by heating the ends until they can be removed and the broken spring withdrawn. Then the new spring is inserted and the ends soldered in position. Care, however, should be used that the soft solder does not bubble and flow out upon the surface of the beads or spiral. Snap bracelets are not considered difficult to repair, but we would advise caution in the use of soft solder. Nethersole and all hollow bracelets should have an air hole drilled into them before any soldering, which is liable to prevent the escape of the heated air, is done. When the bracelet is boiled out, a light green effervescence will be seen at the hole. This is the sulphuric acid pickle. To remove this

pickle, boil or lay the article into a strong solution of washing soda.

To Make a Nethersole Bracelet Smaller.—If a Nethersole bracelet measures 2¼ inches in diameter and it should be 2 inches in diameter, multiply each diameter by three, or, more exactly, by 3.1416. This will give the circumferences of the bracelet before and after cutting, and the piece to be taken out will be the difference between the two amounts. For example, we have a bracelet measuring 2¼ inches in diameter and the customer wants it to measure 2 inches in diameter, then we proceed as follows:

3.1416	3.1416	7.0686
2¼	2	6.2832
6.2832	6.2832	.7854 which equals 78/100, or
.7854		
7.0686		

a trifle over ¾ of an inch. By using the number 3, the process is greatly simplified, thus:

2¼	2	6¾
3	3	6
6¾	6	¾ of an inch.

Bonnet Brushes to Repair.—Broken bonnet brushes are hard soldered whenever possible, but, in some cases, beauty is often sacrificed for strength. When the top is broken out, take a piece of silver and cut it to cover the broken part. Then perpendicularly on this, solder a heavy piece of brass tubing, which should fit nicely into the handle of the brush. Then the plate may either be soft or hard soldered to the top of the brush. When this is done the tube is cemented into the handle.

Silver Novelties to Repair.—Many novelties, and especially those bought in department stores, are not worth repairing, but it will not do to refuse this work when it is brought in. As most of the handles are filled with cement this must be removed before any soldering can be done. If the article is a tooth brush, which has broken off right at the mouth of the handle, heat the handle at the other end until the heated air and cement force out the broken end. If it does not yield in this way, press it down into the handle. After all cement has been removed, clean the handle in sulphuric acid pickle, then wash and dry. Now make a brass or German silver ferrule that will slip inside of the handle on either end of the break and join the two ends. Then coat the joint with borax and lay on the small pieces of easy flowing silver solder. When the borax has dried, heat the handle until the soft solder flows into the joint. If the broken article has been filled with soft solder the work is very much more difficult. Remove the excess of soft solder by holding the article over the alcohol flame until the solder is melted, when it can easily be poured out. The remaining solder can be removed by allowing the article to lie in the soft solder destroyer. It is advisable in some cases to soft solder articles of this kind when the silver is of an inferior quality or is very thin. In either method, use the ferrule in the inside to strengthen the article.

Watch Case Bezel to Repair.—Before soldering the bezel, the place to be soldered should be carefully filed to make a good joint. Binding wire is then wrapped around the bezel several times; but before drawing it tight take a piece of wire of such size that it will fill the glass groove and extend a little beyond the ends. Bend the wire to correspond to the groove and lay it in, after which the binding

wire encircling it is tightly drawn. Anti-oxidize the bezel, then apply the borax and a small piece of solder. Next gradually heat the part opposite to the break and slowly pass around to the joint with a small and gentle flame. When soldered, remove the wire and boil the article in pickle, after which the solder, if any, is removed from the groove with a graver and the outside filed and rubbed smooth with fine emery paper.

Watch Bows to Refill.—Watch bows worn thin in places are refilled by placing a small piece of gold in the worn spot and flushing it with solder. Solder, in itself, is too soft to stand the wear; so the gold should be inserted to insure wearing.

Belcher Rings to Repair.—Repairing the setting on a belcher ring is rather a difficult job, for there should be a number of new claws, usually eight, soldered in the right position. It must be borne in mind that the old prongs are to be filed off sufficiently to give the new ones a firm hold on the base; otherwise when setting the stone they will be liable to be broken off. Some repairers, after filing off the old setting, make a ring of gold about 3-16 or ¼ in. high and solder this in position. It is difficult to make this ring, for the gold should be as thick as the base on which it is to be soldered. When made up it is rounded on the setting mandril described in a previous chapter. When the ring is made it is tied in position and charged with borax and solder. After the borax has dried the ring is heated until the solder flows and joins the two parts. This done, file the top of the new setting flat and mark out the number of new claws to be made. The gold between the prongs is sawed out by placing the saw through the center of the setting and sawing downward, but great care should be exercised that the

bottom is nicely rounded and the claws even and straight. This is all a matter of practice, for, after doing this work several times it becomes comparatively easy. When all sawing is done the sides of the prongs and the rounded parts of the scallops should be smoothed with fine needle files. This will greatly facilitate the polishing. The inside of a new setting of this kind is polished by rubbing it back and forth on a linen or cotton string or strips of chamois skin which have been charged with tripoli and oil, or, what is cleaner, the prepared tripoli composition which can be secured from any material dealer. It is not necessary to use one string only, for several may be used at the same time. When the parts have been thoroughly smoothed the ring should be washed to remove all grease and grit, after which the inside is polished in the same manner as before, excepting that rouge is substituted for the tripoli. In factories the sides and top of prongs are polished on wood-laps before being brushed with rotary brushes, and it would be advisable for the repairer to finish his work in this way if he has the facilities for doing so.

Chains to Repair.—Silver fox-tail chains, when broken at the swivel, are often attached by opening the end link with a pin-tongue and inserting a jump ring. When broken some distance from the swivel, lay a piece of solder on each end of the break and melt. Then cut off as much of the ends as possible, leaving just sufficient to make two nice, solid surfaces which are joined and soldered together. This is the best way of repairing this kind of chain, as it prevents the solder from flowing any distance, which would stiffen the chain. This chain is made like new by drawing it through an alcohol flame until it is thoroughly heated and then allowed to cool; after which it is allowed to lie in the sulphuric

acid pickle until it becomes perfectly white. Some prefer the white finish, but, if the bright is desired, it is necessary to polish the chain with the brass scratch brush. It is also done by briskly brushing the chain with bi-carbonate of soda, but the result is not so good. Rope chains, made with unsoldered links, are repaired by opening the two links at each end and hooking together. This is not so difficult with the larger size of chains, but a great deal more so with very small chains. Care should be taken that the break is repaired on the proper twist; otherwise the repaired place will be noticeable. It is not necessary to solder links in an unsoldered chain, but it is necessary to do so in a soldered link chain. To solder chains of this kind use very small pieces of solder and, if possible, solder the ends of the links together. This will mend the break and leave the chain as pliable as before. Wherever possible, save the color of these chains by using the anti-oxidizer; but if a pickle coating is visible it would be well to gild the soldered parts before any polishing is attempted.

Charms to Repair.—Charms and lockets may be broken in so many different places that it would be difficult to enumerate all at this time. Generally, however, they are broken at the joints or at the top ring. If the joints on a plated charm or locket are broken, remove all parts that are soft soldered in position. Then remove all soft solder remaining on the part to be repaired. If the joints are split out or broken from the knuckle, remove the rivet and insert a round steel broach and try to hammer the joint back into its former shape and position. The tapping or hammering should be done lightly, so as to leave as few marks as possible on the joints. All being clean and the joints tied in position, proceed to anti-oxidize the whole and

charge with borax and solder. Then solder with an easy flame and as soon as the solder flows nicely, withdraw the article and allow it to cool, after which it should be cleaned in the sulphuric acid pickle. As many of these lockets are gilded on the inside, it would be well to clean the inside and coat the outside with any resist—coach painters' varnish will do—and then dip the whole into the warmed Roman coloring solution. This will produce a nice finish on the inside, similar to that on the other parts. The resist should be removed and the whole put together, after which it is polished and washed. If rings are broken off or worn on plated charms, which are soft soldered together, it is advisable to remove all the parts and clean off all soft solder before any soldering is done. This may be removed by scraping, which is by far the quickest method, or by the use of the soft solder destroyer. If the rings on solid gold lockets or charms, or plated ones that are not soft soldered, are worn they can easily be filled by wrapping the charm in moist tissue paper and then holding it between the forefinger and thumb of the left hand. But when the rings are broken off of an elk tooth or similar charm the tooth or other destructible parts must be removed. Wherever possible, use the anti-oxidizer, as it will save both labor and the engraving on all articles. When repairing anything containing cement or shellac be sure to have all removed before attempting any soldering, as, otherwise, the cement would boil out and prevent the solder from flowing.

Watch Chains to Repair.—When any repairing is to be done to a watch chain, the repairer should examine all rings which compose the toggles to see that the ends are perfectly joined. When the swivel ring is drawn out of shape, it should be bent back and the swivel itself put into first-class order.

If the catch does not spring back with sufficient strength to close entirely, remove the rivet from the swivel, stretch the spiral spring a trifle and replace it. This, if carefully done, will remedy the defect. Watch chains, as ordinarily broken in one or more links, do not require so much patience as skill in their repair, but where chains are to be entirely refilled, both patience and skill are required. Watch chains which are worn thin are refilled by placing small pieces of gold into the worn spots and flushing the whole with the best solder that the chain will stand. One will notice that a chain of this kind is much shorter after it has been refilled than it was before, and the result will be surprising if one takes the trouble to measure the chain before and after refilling it. We have heard of customers asking if some of the links had not been removed from the chain. If solder only were used for refilling the chain links it would be entirely too soft and would wear out in a short time. To obviate this the harder alloy is substituted. When doing this work on a curb chain, take a flat piece of charcoal in which a groove is cut to receive the second link of the chain while the first lies perfectly flat on a charcoal block. Of course the other end of the chain is doubled up into the end of the block or allowed to pass over the edge, in which case it is secured by holding it with the index finger or thumb of the left hand. This being understood, the repairer will, after the chain is perfectly clean, lay a small piece of gold, filed somewhat to the shape of the worn spot, in position and charge with borax and solder. Then the piece of gold is soldered in place and the end of the chain dipped into the sulphuric acid pickle and rinsed in clean water. The other end is then placed in the position of the first and soldered in the same way. Then, by repeating this, link after link, each one as it is refilled is

doubled back on the chain. The whole chain will be refilled without much difficulty. After the entire chain has been refilled it should be boiled out in the sulphuric acid pickle and rinsed in clean water. Then the links are filed into shape and as the finishing is a matter of everyday practice, we will not go into any details on that head.

The worn rings of the toggle cause much more trouble than the larger links of the chain. In most cases it is advisable to cut the rings apart to refill the worn spots. In some chains there are two links soldered together. Should this be the case, cut the end link of the two and then every other one in the same order. After being refilled the cut link can easily be soldered by using a little care. As these toggles are rather difficult to polish inside they may be cleaned and given a dip in the Roman coloring solution. We have known repairers to pursue the same method with the inside of the larger chain links; but where polishing can be done it would repay one to do a little extra work, as the chain will look a great deal better for so doing.

Cornets to Repair.—As jewelers are frequently called upon to repair musical instruments and especially cornets, we will endeavor to state how the more frequent breaks are repaired. The valves usually cause the most trouble, either because they are tight and cannot be moved or the slide will go down and not spring up. To remedy this defect it is necessary to take the valve apart, both below and at the top. Then perfectly clean all the parts and if it is seen that there is any considerable friction anywhere, take powdered pumice stone and water and place some inside the tube and insert and revolve the slide on the inside until all friction is overcome, when it and the dirt are removed and the

parts re-adjusted. If it works easily the defect is remedied, but if it does not it will be necessary to use caution in the rubbing process so that the slide or valve tube is not bent or dented. The slides and caps of the valve should occasionally be oiled, both above and below. No more oil than is absolutely necessary should be used, as it would work into the valves and cause trouble. Sometimes it would be well if the repairer would pour several quarts of water into the bell and turn the instrument so that it would cleanse the inside, the water being then allowed to flow out at the mouth-piece. The cork or padding at the water-key should always fit tightly, as the slightest leak at this point would impair the tone of the instrument. Should the metal edge be broken off, remove the spring and, after thoroughly cleaning both parts, apply soldering fluid and soft solder on the inside edge and solder with the blow-pipe. If care be taken the solder will not flow on the outside. Then apply a little non-gumming oil to the spring and wipe it off thoroughly before re-adjusting it. It is advisable to use as little on as possible in a cornet and especially on the valves. Saliva is the best lubricator we know of for this purpose.

Combs to Repair.—When the silver backs of combs are cracked the rivet holding them in position should be removed by filing off the smallest head and pushing it out by using the rivet pliers or a small punch. Then scrape the fractured edges and join nicely on a piece of charcoal. Charge with borax and solder on the inside, otherwise the solder will flow or lump on the outside in the scroll work or engraving. The solder on the inside will act as a brace in places where before there was a strain. Should there be but two rivets which secure the back to the comb, it would be advisable to put in one or two more to make the back more secure.

When the comb itself is broken the repairer cannot do better than to put in a new one. Sometimes celluloid combs are joined together, but it is better to put a new one in at once. Tortoise shell combs are quite frequently repaired. This is done by softening the parts in clean boiling water and then joining them between heated plates in a vise. This is a job which requires considerable skill and experience, but it is worth the repairer's time to try it. After the comb is repaired, or, for that matter, any tortoise shell article which is brought in, it is polished by using a mixture of soap and whiting on the rotary bristle brush and finally on the flannel buff. Another and perhaps a cleaner polishing preparation is made by intimately mixing vaseline and rotten stone or olive oil and rotten stone. The bristle brush should be used first and care exercised that the friction does not burn the shell. The buff is used next, after which the article is briskly rubbed with the palm of the hand.

Casts to Make.—Very often the repairer meets with articles as heads, eagles, etc., of which it is desirable to keep models. In order to do this he should provide himself with a soft wax, usually called impression wax, and fine calcium plaster. To take an impression the article, if possible, is laid on a flat surface, and after the wax has been moistened on the tongue, it is pressed on to the article. Care, however, should be taken that it is pressed down evenly without a rocking motion, otherwise the impression will be imperfect. After the wax impression has been obtained, mix calcium plaster with water until it is the consistency of a medium thick paste, and pour into the mould. In doing this it would be well to stick a pin or point into the plaster, to allow all air to escape. If this were not done, small air bubbles or hollows in the model would be

the result. The plaster is allowed to dry slowly for several hours, or until it is perfectly hardened. Then the model can easily be removed by pressing the wax away from it on all sides.

If the workman can keep the article long enough, it would be advisable for him to make a plaster impression of the article instead of one of wax. Proceed in the manner outlined above, and after the plaster has dried, which usually requires from two to four hours, the article can be removed. This is done by taking a point or knife and inserting it under an edge where the metal will be poured when a casting is made. For instance, we have an elk head of which we desire to have a metal copy. Place it on a flat surface, and pour the plaster paste over it. When dry take a pointer and insert it at the neck or what would be the base of the head. Then after the head is removed from the plaster cast a groove or trough is cut to the edge of the plaster to allow the free passage of the molten metal. Another plaster cast having a flat surface can be made, and this should have a trough cut into it to correspond to the other one. The trough should be larger at the mouth than at the model, so as to receive the metal better, and for the pressure. Then if it be so desired, a leaden model can be made which will be ready for use at all times. This is made by melting lead in a tin boxlid and pouring it into the mould. Allow to cool for several minutes, and lift the side with the flat surface. Then the leaden model can be removed and cooled, after which it is finished to correspond to the original.

Earrings to Repair.—The connecting rings on earrings usually break where the rings rub together. If these are not worn too thin or broken off, they can easily be refilled. To do this remove

all stones that are likely to be injured when heated, and anti-oxidize the setting. A suitable piece of solder is then laid upon the worn spot and heated until it melts and flushes the worn parts. Very little filing is necessary if care has been taken in the soldering, as the solder will conform to the shape of the ring. When all the rings are refilled, boil them in the sulphuric acid pickle and rinse in clean water. Then join all the parts, and proceed with the polishing. If the rings are broken off, make or secure wire of the original thickness of the connecting rings and take a piece of steel wire which would pass through the original ring and fasten it together with the end of the gold wire in a hand vise. Then by holding the hand vise in the right hand and the end of the gold wire with a pair of pliers in the left hand, proceed to revolve the hand vise away from the body. This will make a spring which can easily be slipped from the steel wire. Then with a saw-blade saw lengthwise on the top of the spring until the rings separate. These are called jump rings, and they are now ready to replace the worn or broken rings.

With the flat pliers join the ends of the jump ring and file a flat surface right on the joint. These rings are used on the bows or wires. Those used on the settings have the flat surface filed to one side of the joint, to allow the ring to be opened to engage the top one.

Engraving to Remove.—The repairer is sometimes called upon to remove engraving from silver handles, watch case shields, etc. The former can be removed with a file having a curved end, the file marks being removed by the use of a piece of Scotch hone and water.

Engraving on the shields of gold or silver cases can be removed in the manner just described, but

on filled or plated cases a piece of metal must be placed over the engraving.

Take a print or pattern of the shield, and make one out of a thin piece of gold or plate which will cover the entire surface of the shield. Then lay the under side of the piece on a flat piece of charcoal and flush it with a thin layer of silver solder. Then clean the piece in pickle and rub a file over the solder to smooth and remove any excess. The two surfaces to be joined are then cleaned thoroughly, boraxed and joined. The piece is secured in position by means of binding wire placed around the back and drawn tight. Then one end is cut off right inside the snap edge and bent down so as to hold the wire in place. The other end is bent over and cut off in the same manner. This method of tying on a plate will prevent the back from being drawn out of shape while being heated. Anti-oxidize the back inside and outside, and allow it to dry. Then with a steady flame heat the entire back until the solder melts and shows a white line at the edge of the shield. The back is allowed to cool and the wire removed, after which it is cleaned in pickle and polished inside before it is fastened to the center.

Some repairers use soft solder for this work, but wherever hard solder can be used it would be much better to do so. After the shield is soldered in position and the back polished, the repairer should bevel the edge of the plate by bright-cutting it with a flat graver.

Fluxes.—Crystallized borax, obtainable in drug stores, is one of the best fluxes for the jewelry repairer's use. Prepared borax, containing sal ammoniac, is very good and is used by very many repairers. Liquid fluxes, used for anti-oxidizing as well as for fluxing, are good, but they have a tendency to cause the solder to spring away when the

flux is heated. Cyanide of potassium is a good flux, but is entirely too dangerous to be used about the work bench. Many repairers unconsciously hold the fluxing brush between the teeth while working on a job requiring several solders, and if cyanide of potassium were used, the results might be fatal to the workman.

Filigree Work to Clean.—Filigree work is cleaned by laying it on charcoal and heating it to a dull red with a steady, even flame. Then allow it to cool before placing into the sulphuric acid pickle. If the dead white finish is not desired, a bright finish can be obtained by the use of the brass scratch brush, which should be kept wet with water. If the edges only are to be bright, put some moist baking soda onto a towel and rub the parts to be made bright.

Fountain Pens to Repair.—Jewelers are frequently called upon to unscrew fountain pen holders at the joint. To do this, hold the joint over an alcohol flame until warmed and, then, by grasping an end in each hand, suddenly twist as in unscrewing. If sufficiently warmed the parts will separate with ease. If the pen does not feed sufficiently take it apart and clean thoroughly with alcohol. Grain or wood alcohol can be used for this purpose. Then put the pen together and, in many cases, it will be all right. If this does not remedy the defect, the capillary channels are too small, or the position of the feeder should be changed. Very little enlarging of the channel will often change the flow of the ink from the barrel. It would be almost impossible for a jeweler to repoint the nib, as this is a very difficult and tedious piece of work; therefore, when a job of this kind is brought in, it should be sent to a manufacturer, who is thoroughly equipped for this work. If the barrel of a fountain pen becomes worn

and it is to be repolished, smooth the surface with pulverized pumice stone and oil. Wash this off and polish the article with oil and rotten stone. If the cap of a fountain pen becomes so large as to easily slip off the barrel, it should be tightened. A piece of heavy binding wire is taken and passed around the cap about one-eighth of an inch from its extremity. Then by twisting the two ends the cap can be contracted so as to fit the barrel tightly. When it is as desired, gently heat the contracted part over an alcohol flame and allow to cool, and remove the wire. If warmed sufficiently the cap will be just as it was when bound by the wire.

Fobs to Repair.—Fobs usually have the silk worn so that the putting in of new silk is all that is required. Before doing this the attachments should be tested, and if found satisfactory, they are polished. See that all jump rings are evenly joined and the swivel in good working order. Then, after inserting the silk, stitch it and the bar so that it will stay in position. The lower ends may be cut square and frayed or cut into an inverted V-shape. The latter is preferable.

Ferrules to Make.—Cracked umbrella handles and fountain pens are sometimes brought to the jeweler to have ferrule placed around them. This is a job that requires accuracy, for the ferrule should fit tightly to overcome the trouble and should not be higher than the surface of the article, if it is to be placed on the end. To make a ferrule, secure a piece of the metal—brass, silver, etc.—the desired length and width. Then cut a groove around the handle so that the depth will not be quite as much as the thickness of the metal, and tie a piece of binding wire around the grooved part and twist the ends together. Cut this apart at the twist and the

piece will be the length of the strip for the ferrule. Mark off the distance on the strip and bend up the ends, as in making a ring. The joint is prepared, joined and soldered, after which the solder on the inside should be removed. The rounding up sometimes causes considerable trouble if one does not have different sized mandrils, but by means of screwdrivers—pieces of round steel—this can easily be done. When the ferrule is round, fit it to the piece and if it is a little tight it may be forced on. It is better to have it this way than have it too loose. If it is found to be all right, remove it and file the surface and edges, and then, after removing the file marks with emery and scotch-hone, polish it. Place it on the edge of the prepared part and strike the upper edge with a rawhide mallet to drive it into position. When this is done file the top edge smooth and even with the wood and smooth with a burnisher. There are many kinds of ferrules to be made, but by following the principle here given no trouble will be found while making any of them.

Filings to Reduce.—Jewelers who do not save the filings from their work bench would be surprised at the amount of gold that is lost in a year. These should be collected and cleaned every week. When a sufficient quantity has been gathered, it may be reduced and melted. The filings are placed into a sheet-iron box, lined with a piece of tissue paper and placed over a charcoal fire. This will cause the wood filings and other foreign matters to be destroyed. When the filings have undergone this treatment sufficiently—which will be known when they cease burning and become black—cool and place them into an iron mortar. With a pestle reduce very fine and go through them with a strong magnet to remove all steel and iron filings. The filings are then thoroughly mixed with an

equal amount of saltpetre and placed into a large crucible which should be about three-fourths full of the mixture and saltpetre added to entirely fill it. This is placed in the melting forge until the metal melts and flows to the bottom, where it forms into a button. Many jewelers send the button thus obtained to the mint or to a refiner. This is certainly the best way of dealing with it; but as some may wish to separate the metals we will describe the methods employed:

The button of gold is taken and to it is added about one-half of its weight of silver and the two are melted together and, when thoroughly incorporated, are cast into an ingot mould. Borax or potash can be used as a flux, when melting the two. The bar of gold thus obtained is rolled until it is very thin, after which it is cut up into small pieces and placed in a glass jar or other suitable vessel to which nitric acid and water in the following proportions are added:

Gold	1 oz.	
Nitric Acid.....	1 oz.	(fluid oz.).
Water	2 oz.	"

The acid should be slowly heated and allowed to act for several hours when all the alloys excepting the gold will become dissolved. The latter will be found at the bottom of the vessel in the form of a dark brown powder. When the acid fails to precipitate any more of the dark brown powder, it should be decanted into another vessel and saved. The dark brown powder should be thoroughly washed with hot water to remove any trace of alloy that still remains. The water is then poured off and the powder allowed to dry. This is melted with borax or potash and the resultant bar will be pure gold or very nearly so. If, when working up, the gold is brittle, it may be understood that the baser metals were not all removed. In that case

the refining process should be repeated. The trouble and expense connected with this work is greater than it would be if the jeweler would send the filings, together with his polishing dirt and sweepings, to a refiner, who would have all the dirt and trouble and yet charge a very small sum for its reduction. If salt is added to the decanted liquid, previously mentioned, the silver will be precipitated to the bottom of the vessel as a nitrate. This is washed with warm water to remove all foreign matter and dried. Melt with borax and cast into ignot moulds. To make a silver plating solution add a saturated solution of cyanide of potassium until all the silver is redissolved.

Impressions.—Engravers frequently desire to take a print or impression of a fine piece of engraving. The best method that has come to our notice for doing this is to touch the finger to the tongue and slightly moisten the engraved surface. Then heat a stick of good sealing wax and press it onto the engraving. The piece of wax should be large enough to cover the engraving without spreading, otherwise the impression will be spoiled. When the cement has cooled remove it from the engraving and coat it lightly with printer's ink. Take the print from this in the usual manner.

Jump Rings to Make.—Gold and silver as as well plated jump rings of various sizes should be kept on hand by every workman. Secure a piece of wire of the metal needed and draw it to the desired thickness. Then anneal and polish it with fine emery paper, a chamois rubbed with tripoli composition, and, finally, with a rouged chamois. After polishing the wire, fasten it and the desired size of forming wire in a hand vise. Then hold the end of the wire in the left hand and revolve the

hand vise in the right hand. This will form a spring on the forming wire, which, when sawed apart lengthwise will separate the rings, which are technically called jump rings.

Locks to Repair.—The tops of small bracelet locks very often become loosened when the key is withdrawn. To resolder these tops clean the surfaces thoroughly and apply the soldering fluid. Very little or no extra solder is needed. Place the top onto the lock and hold the two in position by means of the split tweezers and heat until the solder flows and joins the two parts. The surplus solder is easily removed with the scraper.

Mosaic Pins to Repair.—Broken mosaic pins and brooches are soldered by placing them top downward on a piece of sheet iron or other metal. It would be advisable to tie the two together whenever this is practicable. Soft solder only can be used.

Mercury to Remove.—Mercury on gold and silver articles is removed either by heat or by nitric acid. The latter is the preferable method. Apply the acid with the long stopper of the acid bottle and after a moment or so rinse the article in water and repolish it.

Mirror Backs to Wash.—Sterling silver mirrors, after being polished, can be washed without any danger of water getting back of the glass, by folding a towel and laying it on a stool or table upon which the mirror is laid with the glass downward. When washing or brushing, the water which passes over the edge of the mirror back will be absorbed by the towel.

Nuts to Tighten.—The holes in earring nuts are closed by placing the nut in a vise and striking the

hole with a staking tool or punch. Afterward cut a thread to correspond with the one on the post.

Fans to Repair.—Broken fan sticks are usually repaired by riveting a strip of metal about 1 or 1½ inches long over the break. Another way is to cut a groove on the under side of the stick, about ⅛ of an inch wide and about ½ inch long on either side of the break. This groove should be from a 32d to a 16th of an inch in depth. Into this groove is fitted a piece of bone or other hard substance and cemented with a strong glue. Major's cement has been found an excellent article for this purpose. After drying thoroughly the surplus cement and inserted bone can be removed with a file. This method of repairing fan sticks is, no doubt, the best and neatest. When the sticks part at the joints, clean the edges and re-cement. Always allow the glue or cement to become perfectly hardened before attempting to finish the repair job. For gluing down lace, etc., a mere trifle of Major's cement, applied with a match stick, will secure it without any of it showing through.

Gilding to Remove.—Gilding on articles can be removed by the electrical process or by heating. By the first method the article is attached to the positive pole of a battery and immersed into a saturated cyanide solution. Then attach a piece of copper to the negative wire and immerse into the solution. The gold will be dissolved from the gilded article and a part held in solution, while some of it will be deposited on to the copper plate. The second method is the quickest and in many cases the best. Lay the gilded article on a piece of charcoal and heat to redness. Allow it to cool and immerse into the sulphuric acid pickle for an hour. One heating often is sufficient, but if the gilding is not perfectly removed proceed as before.

Isinglass.—This substance is used instead of glass for covering pictures, etc., in lockets and is much easier to cut into the proper shape and size. It is also used when soldering enameled articles. Lay the isinglass on the charcoal and place the article on it. Thus, when the enamel becomes soft it will adhere to the isinglass and not become covered with charcoal spots, etc.

Inkstand Tops to Remove.—Inkstand and viniagrette tops are removed by soaking the articles in warm water for an hour or so to soften the calcium plaster. Then with a screwdriver, knife, etc., gently force the top upward. This method very seldom fails to remove any top, no matter how securely it is fastened.

Tooth Brushes to Fit.—Jewelers will find a circular disc of wood covered with coarse emery cloth and nailed onto an old bristle brush very useful in cutting down tooth brushes to fit into silver handles.

Polishing.—The finishing of work after being repaired is as important as the repairing itself. As polishing is nothing more than removing all scratches and marks from the surfaces, we will consider the abrasives used for this purpose. Generally speaking, tripoli and rouge are all that most repairers use, and in many cases are all that are necessary. Before going further it may be well to mention that the very coarse file marks and scratches are removed with an emery stick or by using a piece of moistened Scotch-hone. The latter is obtained in square sticks about four inches long and about ¼-inch square. When in use it should be kept wet, and as it is softer than the metal operated upon a mudlike mixture will form on the sur-

face, which must be washed off frequently to ascertain the progress made. When all marks are removed the articles are ready to be polished on the lathe.

Tripoli is the first abrasive used in connection with an inside felt ring buff or on a bristle brush. This substance can be obtained in the form of lumps, which are covered with oil before using. A more desirable tripoli mixture is to be obtained from all material dealers and is known as tripoli composition. If the repairer desires to make it himself, he can do so by melting nine parts of sperm candle and into this stir 12 parts of powdered tripoli. When thoroughly mixed it can be poured into boxes or moulds and kept for use. Rouge, which is oxide of iron, would be too troublesome for the repairer to make himself, and, besides, it can be bought cheaper than he could make it himself. The kind preferred is hard rouge, known as XXG. Soft rouge mixed with alcohol is used for finishing fine silver pieces before dry-buffing them.

As a rule, most jewelers use a foot-lathe for their polishing, which answers very well, but many others are now running their lathes with electric motors, which, without a doubt, is a great advantage to the polisher, especially if he is called upon to repolish the gold and silver stock of the store. In connection with the lathe very few buffs, brushes, etc., are needed by the average repairer, and generally these are:

2 cotton wheel buffs;
2 canton flannel wheel buffs;
2 felt buffs;
2 taper felt buffs for inside of rings;
1 taper cotton buff for inside of rings;
2 2-row black bristle brushes.
2 4-row black bristle brushes.

With these brushes and buffs nearly all repair work

can be polished, but for some jobs special buffs, brushes, etc., can be obtained and in many cases the repairer can make them himself.

A metallic lap, composed of a mixture of two parts of pure grain tin and one part of pure lead—will be found very useful for giving band rings or new ring shanks the appearance and polish they had when new. Lapping is rather difficult for anyone who does not have much of this work to do, but when one has mastered the art very satisfactory work will be the result. When lapping a band ring it is held between the thumb and forefinger of the right hand and applied to the surface of the lap so that all parts of the ring surface will touch evenly. Then when on the lap give the ring a circular, up and down motion so as to smooth or lap as much of the surface as possible. When one part is done satisfactorily take the ring from the lap with a quick motion and apply another part of the surface to be polished. A wooden lap, which would answer the repairer's needs, can be made by taking a disc of wood six or eight inches in diameter and cutting a hole in the center of it to fit the spindle of the lathe head. Polishing lathe spindles usually have a thread cut on them to receive a nut with which the lap is held in position against the shoulder cut into the spindle. When cut and shaped as desired the disc of wood is placed on the lathe and smoothed with fine sandpaper. This lap, with the use of the tripoli composition, will assist the polisher considerably in producing nice, sharp work. Another small wooden lap having its inner side cut down so as to form a knife edge on the lap, will, with the use of the tripoli composition, be found very useful for lapping the sides of prongs in new settings, etc. This lap should be considerably smaller than the first one and can be nailed on to the side of a worn-out four row brush.

The polishing outfit would not be complete without brass and steel wire brushes. The former is used to clean work before gilding and to finish it after being colored. The steel wire brush is used for satin finishing or "frosting" silver work. All that need be explained about satin finishing is that the surfaces should be free from all scratches and of a dead white color. This is obtained by heating the article to redness and, after cooling, it is placed in the sulphuric acid pickle until it is perfectly white. Then hold the article between the index fingers and thumbs of both hands and present its surfaces to the brush in such a manner that the ends of the wires will strike equally and evenly. It is advisable to keep the brush and articles moistened with water or stale beer to produce a nice finish. With these preliminary explanations we are ready to proceed with the subject of polishing—for instance, of one day's repair work, which usually consists of rings, brooches, etc. This method of describing the polishing process is taken in order to avoid a separate description of the buffs, brushes, etc., that are used and which can be obtained by carefully following the method described below. The repair jobs, as a rule, are kept in envelopes, and, to prevent mistakes, each article is taken from its envelope and a brief description made of it on the inside of the envelope flap, which will assist the repairer to quickly replace the job when polished. When sealed the brief description will be covered and a nice, clean envelope can be presented to the customer. Then cover the lathe bed with a newspaper to catch all polishing dirt, tripoli, rouge, etc., and to one side the jobs can be sorted into several piles in the order of their needs. For instance, rings which have been stretched, pieced or soldered are placed in the first pile. Brooches, spectacles, etc., that have been soldered or had new pintongues at-

tached are laid on the second pile, and articles as rings, pins, watch cases, etc., which need polishing are placed on the third pile.

Before doing any polishing on the lathe Tiffany ring mountings should be polished between the prongs and through the hole at the base of the stone by drawing the setting back and forth on a rouged chamois strip. Likewise it is advisable to recolor the insides or backs of cluster rings, etc., which had the original color ruined in the soldering. This done, the polisher is ready to proceed. Place the tapering felt buff on the lathe and give it a light coating of the tripoli composition, and take the rings of the first pile and, holding each between the forefinger and thumb of the right hand, rub back and forth on the buff until all file marks and scratches are removed. Then join the first and second piles and proceed to tripoli brush the pickle coated or filed surfaces until smooth. Avoid rounding edges of the work. In this connection it is advisable to use black bristle brushes, as, from our experience, it is found that they are tougher and last considerably longer than those made from white bristles. When the surfaces have been thoroughly brushed in two or more directions and are smooth proceed to wash off all tripoli and dirt, as otherwise this would prevent the articles taking a high polish. Benzine is the best preparation for removing tripoli that has yet come to our notice. When all the articles that were tripolied are dried in the sawdust or by means of tissue paper or a towel, separate the rings to make one pile and all of the other articles will constitute the second pile.

The rings of the first pile are rouged on the inside rouge buff in the same manner in which they were tripolied. Be very careful not to allow the rouge and tripoli brushes, buffs, etc., to become mixed; otherwise there would be trouble. Then brush all

the articles with the bristle brushes to which the cake of rouge has been applied and finally finish them on the canton flannel or cotton wheel buffs. After washing the articles with soap, ammonia and warm water, dry them in warm boxwood sawdust. Diamonds should be dipped into alcohol to remove all grease before they are dried in the sawdust. The dry buff—usually canton flannel—is used for dry buffing, without the use of rouge, all silver pieces, as bonbon dishes, etc. The articles that were brushed or cleaned with the brass or steel wire brushes should be brushed briskly with baking soda to impart a nice luster to the work.

Stud Spirals to Repair.—When stud spirals are broken off at the setting it is advisable to anti-oxidize both parts. Then clean the surfaces to be united; borax and lay on the solder. Place the setting on a piece of charcoal and hold the spiral with a pair of tweezers in the left hand. Great care must be taken in soldering so that the setting or spiral is not melted or burned. When the stud is broken in the curve of the spiral anneal and straighten it. When soldered, smooth it nicely with a fine file and polish. After this it should be bent perpendicularly at a distance of 3-16 of an inch from the setting. Then the spiral wire is placed into the spiral turner groove and the fastening pin inserted. When it is seen that the setting would be in the middle of the spiral or circle, grasp the end of the wire in a pair of pliers held in the left hand and turn the spiral turner away from the body with the right hand. When spirals are "sprung" or pulled out of shape, draw the coils together and bind in three or four places with strong or doubled binding wire. When drawn into the proper shape anti-oxidize the spiral and heat to redness with the blow-pipe or over an alcohol flame. After cooling, the wire should be removed and the stud boiled in the acid pickle.

Stone Setting.—In connection with this brief description of stone setting it is desirable that the repairer examine every piece of nice work of this kind that comes his way. Very few tools are needed for setting and resetting stones, and these are: A ring clamp, for holding rings; a cement stick for holding earring and stud settings; a fine barrette needle file; a fine barrette file (larger size); a shad belly graver, No. 4; a flat graver, No. 41; one-half dozen pearl drills, assorted sizes, which can be obtained from any material dealer and are used in the drill pump; two or three beading tools of small size. The shad belly graver is ground back on the left side so as to form an angle of about 45 degrees. This tool is used for cutting the bearing in the settings. With these tools the repairer is able to set or reset almost any stone which may be brought to him.

As very many stores carry an assortment of Tiffany and belcher diamond mountings for mounting loose stones, we will briefly describe how stones are set in rings of this kind. The first thing necessary is to see that the mounting is the right size for the stone; that is, the outer edge or girdle of the stone should cover about one-half of the tops of the prongs when placed on the setting. This is a pretty good rule to follow with Tiffany and belcher mountings, because if the prongs were bent inward the gold or base of the setting would show considerably all about the stone, and if the prongs were bent outward the effect would be equally as bad, if not worse. Care, also, should be taken that the top of the setting is perfectly straight, for if this defect is not remedied the stone, when set, would be found to be crooked. This will be understood if one will hold a mounted stone up before him and see whether or not the table of the stone is or is not at right angles with imaginary lines drawn from the bottom of the ring. If the surface of the table, on all sides, does

not form a right angle with the lines the stone is set crooked and the job is not creditable to the workman. Thus it can be readily seen that the setting should be perfectly straight before attempting to set any stone. If stones are uneven or are cut crooked, allowance is made when cutting the bearing in the setting so that one side would be cut deeper than the other. A great deal depends upon the skill and judgment of the setter.

After the setting has been straightened the setter opens or closes the setting, if necessary, to suit the stone. This can easily be done with the pointed flat pliers in the Tiffany mountings, but very little, if any, bending can be done on belcher mountings. Hence the importance of seeing that the stone and the mounting are of a corresponding size. When the setting is the right size the setter prepares the bearing or bed of the stone by cutting out about one-half of the thickness of the prongs to the depth of one millimeter. This is done either with the shad belly graver described above or with the needle barrette file. Many workmen use the graver exclusively, but, wherever the file can be used, it is advisable to do so, as the work can be done much more rapidly and easily. When all the prongs have been cut in this manner, see that the stone fits into the berth thus prepared. If it does not, remove it and cut away the gold that prevents it from fitting into the setting. Care, however, should be taken that too much of the prongs is not cut away, as this would weaken them. Very often this impediment can be removed by slightly bending one or more prongs with the pointed flat pliers.

When the setting is cut so that the stone fits in between the prongs, proceed to cut away the sharp angle underneath the stone to correspond to the under slope of the stone. The flat graver is used for

this work. When this is done, fit the stone into the setting and if it is straight and rests securely and evenly without unduly pressing against one or more of the prongs—which would cause the stone to "rock" when touched on the table with a pair of tweezers—the prongs are ready to be bent over the stone. If, however, the stone should "rock," cut away the slope where the stone presses the most and refit. If this were not done there would be danger of chipping the stone when the prong was bent over it. Before bending the gold over the stone remove the latter and file the sides of the prongs, at the tops, to a point so as to form a triangle whose base would be about one millimeter from the top. Then file the outside face of the triangle so that the top would be thin while the base would retain its original thickness. The top of the prong, when filed in this manner, will look like a right angled triangle when viewed from the side. Many setters do not prepare the setting in this manner when setting stones, but for the repairer who must do repairing, stone setting, etc., it is advisable to follow this method, as very little filing need be done after the prong is bent over and the bright cutting will be easier to cut even and straight.

The stone is now placed into the setting and, by holding it in position with the forefinger of the left hand, proceed to push over the prong opposite to the finger. The greatest pressure is applied to the lower portion of the slope or bent part so that the prong will rest snugly upon the stone. Be particular that the part that is bent over the stone is not curved in the middle, in which case the gold at the girdle of the stone and at the point of the prong only would touch the stone. This should not be, as *all* the gold above the girdle should rest upon the stone. When the first prong has been bent over the stone, remove the finger and bend over the prong

opposite to the first one that was pressed over. Now if the table is perfectly level and the stone does not "rock," bend over all the prongs. If all is not right, remedy the trouble before going any farther. After all the prongs are bent over, the "bent over" parts are finished by bright cutting. With a polished flat graver which has been rubbed dead flat on the under size and then polished on a boxwood diamantine or crocus paper block, start at the top or point of the prong and cut a beveled edge in one continuous cut. Then cut the other size in the same manner and finally with one cut brighten the face of the clamp. This done on all prongs, see that all the points are pressed down tightly upon the stone.

The above description will apply to all prong settings. The ring clamp is used for holding all rings in which stones are to be set, but earring and stud settings are held by cementing them onto a cement stick. Before doing this, dip a small camel's hair brush into oil and brush the parts which the cement will cover. By so doing the cement can be very easily removed after the stones are set.

Turquoise, half pearls and opals should have the settings prepared as described above, with the exception that the under slope should be cut away very little. Whole pearls and moonstone ball settings are prepared by gouging out the gold from the inner surface of the prong to correspond to the curvature of the gem. Great care must be exercised while bright cutting the prongs on pearl mountings so that the pearl is not scratched or injured in any way. Stones set in Gypsy and other mountings have the gold hammered over them or they are held in position by little beads which are forced up over them. Care must be taken with both methods so that the stone is not chipped or broken.

In brooches, lockets, etc., the half pearl and turquoise settings are made by centering and drilling

a hollow the size required, by means of a pearl drill. Then the number of beads, usually five, are marked off and the star or other ornament cut almost to the edge of the hollow. As the cutting proceeds the graver is allowed to pass to the side of the bead so as to make a continuous bright cut from the point to the stone. After this is done, the stone is placed into the hollow and the beads worked over it with the beading tools. This is done by fastening the tool in a graver handle, so that it may be placed on to the bead so as to slope away from the stone, after which, by giving it a rolling, rocking motion, the bead is worked upward and over the stone. Genuine whole pearls are fastened on pegs with gum mastic. Carbuncles and stones cut *en cabochon* are burnished into the settings with a burnisher or with the flat graver.

In connection with this description of stone setting the following diamond table will be found useful when ordering mountings for stones and also to find the approximate weight of mounted stones:

Diameter Mm.	Weight Kt.	Diameter Mm.	Weight Kt.
1	1/64	7	1¾
1½	1/32	7½	2
2	1/16	8	2¼
3	⅛	8¼	2½
3½	¼	8½	2¾
4	⅜	8¾	3
4½	½	9¼	3¼
4¾	⅝	9½	3½
5	¾	10	4
5½	⅞	10¼	4¼
6	1	10½	4½
6½	1¼	10¾	4¾
6¾	1½	11	5

The "table" referred to in this description is the flat top or top surface of the stone. In a perfectly

cut stone this "table" should measure 2-5 of the diameter of the stone. The "girdle" is the edge which fits into the setting and should, in a perfectly cut stone, be one-third of the distance from the table to the lower flat surface of the stone. The part between the table and girdle is the crown. Below the "girdle" is the "collet," which extends down to the "culet," or lower table of the stone. The latter is equal to one-sixth the diameter of the "table." The number of facets on a perfectly cut diamond is 56, but sometimes the number is 64.

Roman Coloring.—The beautiful finish known as Roman gold is obtained in various ways. The older methods known as the dry and wet coloring processes were much employed for coloring new work, and, as the articles were immersed in the solutions, the acids, etc., dissolved the baser metals on the surface and left the gold in a pure state. These methods cannot be employed in the repair shop because most articles are not able to undergo the dissolving process more than once or so. If this should be done, the articles would become honey-combed and liable to break with the least pressure.

For repairing purposes, Roman coloring is done by the electrical process—just the reverse of the former, for in that case the alloy was dissolved from the article to be colored, while by this method the gold is dissolved from the anode and deposited in a uniform coating upon the article. The solutions for this purpose are made in several ways. The easiest method is to dissolve three 15-grain bottles of chloride of gold and one-half ounce of cyanide of potassium in a pint of distilled water. Another method is to dissolve the gold from the anode directly into the cyanide solution. To do this, dissolve an ounce of cyanide of potassium in a quart of distilled water. Then procure a porous cup—a

crucible will answer—and nearly fill it with some of the cyanide solution. The porous cup is then placed in the liquid in the larger vessel so that the two solutions are on the same level, but do not come in contact. This done, weigh the gold anode (a flattened gold coin is used by many for repair work) and, after attaching it to the positive wire, suspend it into the solution contained in the larger vessel. Then attach a piece of sheet copper to the negative wire and suspend it into the solution in the porous cup. Heat the solution and allow the current to pass through it until one and a half or two pennyweights of gold are dissolved from it. This is determined by weighing the anode after it has been in the solution for some time. Very little trouble will be experienced in making the solution, but in keeping it constant, so as to procure a nice color from day to day, requires the watchful care of the workman. As cyanide of potassium plays an important part in the solution, care must be taken that not too much is added nor too little allowed to be in the solution. If there is not sufficient held in the solution, the anode will become grayish and dirty, but if there is an excess of cyanide the anode will become very clear and bright. So, to keep the solution in good working order, it should be kept clean and the anode should have the natural color of a piece of pure gold.

Work that is to be Roman-colored or gilded must be *absolutely* clean. Don't attempt to color dirty or greasy articles. To clean work, brush it with the steel or brass wire, with a brush upon which water is allowed to drop. Before dipping it into the solution wash it with baking soda and ammonia. Then attach the article to the negative wire of the battery and immerse it into the solution. A short time only is required to give the article a dull yellow color, which, when brushed with the moistened

brass brush becomes the Roman color. But this is easier said than done, for the workman often must manipulate the solution, etc., to obtain good results. The articles will receive a nicer coating if they are kept in motion in the solution, which should be heated until the water in the surrounding vessel reaches the boiling point. Better results are obtained by keeping the anode and cathode separated as much as possible. In the case of large articles, the anode should be held deep in the solution, but for small objects it is advisable to immerse only one-quarter to one-half of it to obtain a nice color. In finishing, the brushing should be done as lightly as possible, to avoid giving the work a brassy appearance. Then wash the articles with ammonia and baking soda, and dry them in warmed boxwood sawdust. A green gilding can be obtained by taking some of the Roman coloring solution and substituting a silver anode for the gold one.

SIMPLE METHOD FOR MAKING UP A GILDING SOLUTION.

To start with, you must be sure to follow instructions implicitly. First, you must have pure gold. Any old piece of gold that you have around the shop will not do, as, if there is any silver in the alloy, the silver will take on so much faster than the gold that you will get a greenish color instead of the clean yellow that is so desirable.

Then, you must have clean receptacles, and if you should use granite ware or enameled ware of any kind, be sure that there are no checks or cracks in the enamel where the solutions could come in contact with the metal, generally iron, base, as this would ruin your solution at once. Clean water, that has no mineral content, distilled, is the best.

Now, for building the solution:—Take 6 dwt. C. P.

Cyanide of Potash, and 8 oz. of water. Place this in your enameled dish and heat to about 175° to 200° F. Do not let it boil.

Hard solder the piece of pure gold that you are going to use as an anode to a piece of copper wire, one or two feet long and about one millimeter in diameter, and attach to the side of your battery or dynamo, from which the least bubbles are freed.

Take another piece of wire the same size and length, and attach to the other pole of the battery or dynamo, and run for ten or fifteen minutes, and you will have built up a good solution and are all ready to put in articles to be colored.

GREEN GOLD PLATING SOLUTION.

To three parts of gold solution in good working order, add one part silver solution. Use 17 K. Anode of fine gold, alloyed only with silver. This plates light green. To obtain dark green, add few grains of powdered white arsenic until desired shade is obtained.

ENGLISH OR GUINEA FINISH.

Put a high polish on the work to receive this finish. Wash good and rinse. Then dip in a new Roman solution for a few seconds.

It is sometimes necessary to refinish old gold filled jewelry such as chains, brooches and watch cases, which have no intrinsic value, but because of some sentiment attached to it, the customer desires the piece put in first class condition.

This can be done by first polishing carefully and boiling in a solution of water with a few drops of ammonia and a pinch of soap added. Brush off any dirt that remains, and rinse before placing in the solution. Do not handle any more than necessary after

rinsing. Give article to be plated two or three dips of about five minutes each, brushing with soft brush and soda between dips. Polish with a soft wool buff, and fine rouge. Wash the article and dry in sawdust.

12 K. RED GOLD SOLUTION.

To a pint of gold solution, add a teaspoon of copper trysalt or copper acetate, and use 12 K. anode alloyed only with copper.

BEADED OR MILGRAIN SETTING.

Lay out the work so the seat for the stone is exactly in the center of the plate in which the stone is to be set. This is very important as a small difference one way or the other makes the whole piece look out of true.

Next, drill the hole for the stone 3/10 to 5/10 of a millimeter smaller than the stone. The amount of surplus left for the seat depends on the size of the stone, about 3/10 millimeter for small stones, 4/10 millimeter for medium stones, and 5/10 millimeter for large stones of a carat or over.

Then ream the hole large enough so that the girdle of the stone sets slightly below the surface of the metal. Raise a bead in each corner with a square graver. Start this bead about one millimeter back from the hole. Then cut a groove with a knife edge graver on each side of the bead, starting in the same cut made by the square graver and cutting off to an angle and depth of 45°. After this is done, bright cut the bevel between the beads with a flat graver.

The way to determine the number of rows of bevels to milgrain is to measure the space left after the hole for the seat is cut, and allow about one millimeter space for each row of milgraining. Do not leave too

much space between the rows of milgraining as this will make the job look crude and rough.

Now, with a round bottom graver or a scraper, undercut each bead slightly so that the stone fits snugly, not too loose or too tight. Inspect it carefully to see that the stone sets level all the way round. If it does not, remove the stone and cut the seat lower at the point where it was high.

After the stone sets level press the beads over the stone with a beading tool or purler. This is done by placing the beading tool on the bead, leaning the tool away from the stone at 45 degrees angle, and then pressing firmly on the handle of the tool and with a rotary motion gradually bring the tool to an upright position. Do not force the beads down too tightly at first, as you may have to straighten the stone on one side or the other. Press one bead down on one side, then directly opposite tighten another and so on until all the beads are over the stone loosely.

Now, examine the stone again to see if it still sets level. If it does, go over all the beads again and tighten them securely, taking care that your beader does not slip, as this may chip the stone. This done, go over all the bright cut bevels with a highly polished flat graver and trim off any surplus metal that may still be left around the bead. Good results are obtained on this last bright cutting by using a little oil on the point of the graver when cutting gold, a little turpentine for white gold, and a little oil of wintergreen for platinum.

Next, take the job to the polishing lathe, and with a very short single or two row bristle brush, polish the bright cuts around the stone very lightly with tripoli, and then with rouge. The bristles on these brushes should not be over one-fourth inch long.

Wash the job and milgrain the edges of the bevels. Rouge the whole job and wash again.

To determine whether or not the stone is set tightly,

take a soft pointed stick, such as a match or piece of pegwood, and try to push the stone out from the under side. Do not use a piece of metal for this as it is apt to chip the stone. If this does not loosen the stone, try pushing on the table and crown of the stone. If this does not loosen it, you may rest assured that it is set securely.

HAND PAINTING ON ARTIFICIAL IVORY.

COLOR SCHEMES.

In painting colored letters or monograms, the color scheme is of great importance, for no matter how neatly you may have the letter designed, if the color scheme is not right your work will be in vain. A good rule to follow is that two shades of the same color are always good taste: then again, such combinations as black and gold, purple and gold or silver are always in harmony. If two colors are desired, choose a bright and a somber color, such as blue and brown, green and gray, crimson and black. These will be found to give pleasing contrasts and will not jar like mixtures of purple and orange or blue and yellow. When using two colors always see that they are in harmony and do not clash. If in doubt as to a combination try it out on the piece of waste ivory. An effective letter may be made by painting a circle of solid color on a piece of ivory and then engraving the letter through the color, when you will have a white letter on a dark background. This method can also be used for border and panel designs with great effect and will be of great use when ornamenting ivory clock cases and photo frames.

The designer should know something about the harmony of color and hence the following table will be of use:

COLORS THAT HARMONIZE.

Scarlet, with blue and green; Gold or yellow, with blue or green; Violet with green or yellow—bright green; Blue with yellow or red; Carmine with green or orange; Brown with blue or red; Wine with yellow or green; Rose with light blue or yellow; Neutral tint with red or yellow; Orange with violet or blue; Blue gray with buff or pink; Olive green with red or orange; Flesh with blue or dark green; Dark green with

crimson or orange; Light green with rose or violet; Light brown with blue or green.

RULES FOR MIXING AND BLENDING COLORS.

Rose—diluted magenta; Brick red—brown and magenta; Golden brown—yellow and violet; Seal brown—yellow and violet; Reddish brown—brown and pink; Dark reddish brown—brown and red; Wine—purple and magenta; Royal purple—magenta and light blue; French red—magenta and flesh; Navy blue—purple and blue; Indigo blue—violet and blue; Plum—magenta and blue; Drab—yellow and purple; Myrtle green—blue and green; Landscape green—blue and yellow; Olive green—blue and yellow; Bottle green; —green and blue; Light green—yellow and green; Dark green—blue and green; Foliage green—green and violet; Mauve—blue and pink; Crimson—black and red; Crimson—red and blue; Bronze—brown and blue; Lavender—pink and blue; Garnet—red and green; Old gold—brown and yellow; Terra Cotta—pink and brown; Maroon—red and brown; Salmon—orange and red; Orange—red and yellow; Gray—black and white.

ORNAMENTED WITH ARTIFICIAL JEWELS, MOTHER-OF-PEARL, ETC.

Ornamenting with jewels and pearls is another way of decorating ivory which is becoming very popular. These stones may be obtained from any dealer in jewelers' material.

The white foil backs may be set in any color of a background but the colored stones must be set in a background of the same color.

To make a design with artificial stones in it, proceed as follows: First, lay out the design as already de-

scribed and outline it with the graver. Then paint the colors in good solid coats and make the outlines, either gold or silver, sufficiently bold to stand up. When this is all dry and hard, *and not before,* the holes may be drilled for the stones. For this purpose, you will require a pearl drill for flat bottom stones, and an ordinary drill for gem cut stones, of the size of the hole required to hold the stone. This is important, as the stones must fit snug or else they will not stay in. To fasten the stones, use celluloid cement, dropping it in the hole by means of a pointed stick, press the stone down good, and allow two hours or more to dry.

Abalone pearl is also used and if the thin cut is used, it may be cemented on the surface without cutting the ivory, while for jet and coral the ivory is required to be cut out to hold it. Artistic effects may be had with small shell cameos, also coral cameos. These are very effective if inlaid on hair ornaments such as combs and barrettes, also frames for hand bags and umbrella handles. Beautiful raised effects may be had by piercing out a design and then cementing it on to the article to be decorated. This method can be used on toilet sets, jewel boxes, etc., with admirable results. Photo frames and clock cases may be made very pretty by simply washing over with large brushfuls of color blended into each other. In doing this, you may use all the colors in the box.

FORMULA FOR CELLULOID CEMENT.

Cut into small pieces some transparent celluloid. Place in a bottle and add equal parts of amyl acetate or c. p. acetone.

Another, and in many cases, the best formula:—Glacial Acetic Acid—one part, Acetone—three parts, Alcohol—three parts. Moisten the surfaces to be united with above solution and when the surfaces become slightly soft, place in contact with each other and

clamp with slight pressure, or bind with cord. Let stand forty-eight hours.

For the colors used in ivory or celluloid paints, use the regular aniline dyes that are *soluble in alcohol,* dissolved in pure acetone. Do not get your colors too strong. If the color is not deep enough with the first coating, you can put on a second or third coating, and in this way get the desired shade. Whereas, if you get it too dark, it cannot be remedied only by scraping out, and the scraping out process ruins the surface.

Be sure that your aniline dyes are *soluble in alcohol,* and use pure acetone for the solvent. Some use amyl acetate.

DISPOSING OF UNCALLED FOR REPAIR WORK.

Many jewelers have a large amount of repair work on hand that has been brought in and, although wanted within a few days, has never been called for. This causes the jeweler considerable annoyance, for aside from the space occupied by the jobs and the trouble of examining them every time another job is called for, he has a considerable amount invested in their repairing on which he cannot realize.

The question has often been asked: How one is to place these articles into the possession of the owners and secure the cost of repairs? This is easily done if the jeweler will adopt and maintain a system by which each envelope containing a job will be marked with the instructions for the repairer: the owner's name and address and the date when received and when promised.

Most jewelers use repair envelopes that have marked spaces for these items, but for some reasons, such as haste, hesitancy in asking names, etc., the filling out is not done, and, as a result, if the articles are not called for, they can hardly be sent to the owners or the owners reminded of them.

After the repairer has finished the repairs the article should be replaced in the envelope, which should be carefully sealed and the cost of repairs marked on the outside.

A drawer containing a compartment for each letter of the alphabet can be used for storing all jobs until called for. At the end of each month the jeweler should send a postal card, of which the accompanying is a specimen, to each person whose job has been in the store a month or more. If at the end of another month the owner does not call, another pos-

Do you remember

An article that you left here some time ago for repairs? It is now ready and, thinking that you may have forgotten it, we take this means of reminding you of its whereabouts. If you will kindly call for it or advise us concerning its disposal you will confer a favor upon us, as we are greatly pressed for room as new goods are arriving daily.

J. B. Samson,

322 E. ORANGE ST.

FORM FOR POSTAL CARD.

tal should be sent, which usually will have the desired effect.

At the end of one year another postal should be

An Announcement

To Our Patrons

WE have concluded an inventory of our stock and find a number of pieces of jewelry, that have been left here for repairs, which have never been called for.

As we desire to make room for new goods, and thinking that many of these articles have been forgotten, we take this means of recalling them to memory.

An early call by the owners of these articles will be appreciated by

J. B. Samson

322 E. Orange St.

FORM FOR NEWSPAPER ADVERTISEMENT.

sent to those persons whose jobs have remained in the store for a year or more, reminding them of the articles and stating that the repairer cannot be held

responsible for articles remaining for more than one year. But this will hardly be necessary, as the other postal cards will usually accomplish the desired result.

If a newspaper announcement is desired, which we would advise immediately after taking an inventory of the stock, the accompanying can be used.

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APPENDIX

THE METRIC CARAT.

From Circular issued by Bureau of Standards.

Beginning July 1, 1913, the Bureau of Standards put into force the international metric carat of 200 milligrams as the unit of weight for diamonds and other precious stones, and will use this unit for purposes of certification of all carat weights submitted to the Bureau for test. On the same date the Treasury Department of the United States Government also began the use of this unit in the customs service for the levying of import duties on precious stones. This unit was also put into commercial use in the United States on this date by practically all the dealers in gems and precious stones through the efforts of a committee representing all the principal firms handling gems.

Recently the movement for the adoption of a uniform standard has met with increasing success, and the new carat of 200 milligrams has been adopted by Spain, Italy, Bulgaria, Denmark, Norway, Japan, Portugal, Roumania, Switzerland, Sweden, France, Germany, Holland, and Belgium, while considerable progress has been made toward its adoption in England.

The carat which has been in use heretofore in the United States, while varying, has been nearer the value 205.3 milligrams than any other. This value has therefore been taken in making up the tables of equivalents given in this circular. The old carat has usually been subdivided on the binary system, the smallest subdivision used being usually one sixty-fourth of the carat. The equivalents in fractions of a carat in these tables are, therefore, given in sixty-fourths. One of the improvements introduced with the new carat is the subdivision of it on the decimal system. The fractions of the new carat in these tables are accordingly given to hundredths of a carat.

Tables 1 and 2 are for the conversion of quantities in the old unit to the equivalent weight in terms of the new metric carat, while Tables 3 and 4 are for the reverse process of converting quantities stated in the new system to old carats of 205.3 milligrams. Table 1 is used for the conversion of fractions of a carat, while Table 2 gives the equivalent of each unit or whole carat from 1 to 100 of the old system in metric carats and hundredths of a carat. If it is desired to convert whole carats and fractions of a carat of the old unit to the new, the two tables can be used in combination; that is, by adding the quantities obtained from each,

thus: Suppose it is desired to obtain the equivalent of 28 45/64 old carats in terms of the metric carats.

From Table 1.....	45/64	old carats =	0.72 metric carats
From Table 2.....28		old carats =	28.74 metric carats
Adding.....28	45/64	old carats =	29.46 metric carats

Or, if it is desired to convert a larger quantity involving several hundred or thousand carats, one uses the equivalents in the last column of Table 2 for each hundred and thousand of the old carats up to ten hundred and ten thousand—thus, to convert $3225\frac{3}{4}$ old carats to metric carats.

From Table 1.....	$\frac{3}{4}$	old carats =	0.77 metric carats
From Table 2.....	25	old carats =	25.66 metric carats
	200	old carats =	205.30 metric carats
	3000	old carats =	3079.50 metric carats
Adding....$3225\frac{3}{4}$		old carats =	3311.23 metric carats

Table 3, instead of giving the equivalent of each 0.01 metric carat in sixty-fourths of an old carat, gives the limits, shown by a brace, of the successive sixty-fourths of the old carat, so that any decimal fraction of a metric carat is equivalent to the sixty-fourth of the old carat shown opposite the limits between which it lies, the limits being given to thousandths of a metric carat. Thus, any fraction of a metric carat between 0.698 and 0.714 is equivalent to 44/64 old carats, according to Table 3. In Table 4 the equivalent of each whole metric carat from 1 to 100 is given in whole carats and sixty fourths of the old unit. For example, to obtain the equivalent of 58.71 metric carats in old carats—

From Table 3.....	0.71	metric carats =	44/64 old carats
From Table 4.....58		metric carats =	56 32/64 old carats
Adding....58.71		metric carats =	56 76/64 old carats
		=	57 12/64 old carats

Similarily, if it is desired to convert 3974.15 metric carats to old carats—

From Table 3....	0.15	metric carats =	9/64 old carats
From Table 4....	74	metric carats =	72 6/64 old carats
	900	metric carats =	876 49/64 old carats
	3000	metric carats =	2922 35/64 old carats
Adding....3974.15		metric carats =	3870 99/64 old carats
		=	3871 35/64 old carats

TABLE 1

Equivalents of fractions of the old carat weight in new decimal metire carats.

Computed on the basis—

1 old carat=205.3 milligrams.

1 new metric carat=200 milligrams

OLD CARAT						New Metric Carats	OLD CARAT							New Metric Carats
1's	1's	8ths	16ths	32nds	64ths		1 carat	1's	1's	8ths	16ths	32nds	64ths	
					1	=0.02							33	=0.53
				1	2	= .03						17	34	= .55
					3	= .05							35	= .56
			1	2	4	= .06					9	18	36	= .58
					5	= .08							37	= .59
				3	6	= .10						19	38	= .61
					7	= .11							39	= .63
		1	2	4	8	= .13				5	10	20	40	= .64
					9	= .14							41	= .66
				5	10	= .16						21	42	= .67
					11	= .18							43	= .69
			3	6	12	= .19					11	22	44	= .71
					13	= .21							45	= .72
				7	14	= .22						23	46	= .74
					15	= .24							47	= .75
	1	2	4	8	16	= .26				3	6	12	24	48	= .77
					17	= .27								49	= .79
				9	18	= .29						25	50	= .80
					19	= .30							51	= .82
			5	10	20	= .32					13	26	52	= .83
					21	= .34							53	= .85
				11	22	= .35						27	54	= .87
					23	= .37							55	= .88
		3	6	12	24	= .38				7	14	28	56	= .90
					25	= .40							57	= .91
				13	26	= .42						29	58	= .93
					27	= .43							59	= .95
			7	14	28	= .45					15	30	60	= .96
					29	= .47							61	= .98
				15	30	= .48						31	62	= .99
					31	= .50							63	=1.01
1	2	4	8	16	32	= .51	1	2	4	8	16	32	64	=1.03

TABLE 2

Equivalents of the old carats in new decimal metric carats.

Computed on the basis—

1 old carat=205.3 milligrams

1 new metric carat=200 milligrams

Old Carats	New Metric Carats	Old Carats	New Metric Carats	Old Carats	New Metric Carats	Old Carats	New Metric Carats
1	1.03	31	31.82	61	62.62	90	92.38
2	2.05	32	32.85	62	63.64	91	93.41
3	3.08	33	33.87	63	64.67	92	94.44
4	4.11	34	34.90	64	65.70	93	95.46
5	5.13	35	35.93	65	66.72	94	96.49
6	6.16	36	36.95	66	67.75	95	97.52
7	7 19	37	37.98	67	68.78	96	98.54
8	8.21	38	39.01	68	69.80	97	99.57
9	9.24	39	40.03	69	70.83	98	100.60
10	10.26	40	41.06	70	71.86	99	101.62
11	11.29	41	42.09	71	72.88	100	102.65
12	12.32	42	43.11	72	73.91	200	205.30
13	13.34	43	44.14	73	74.93	300	307.95
14	14.37	44	45.17	74	75.96	400	410.60
15	15.40	45	46.19	75	76.99	500	513.25
16	16.42	46	47.22	76	78.01	600	615.90
17	17.45	47	48.25	77	79.04	700	718.55
18	18.48	48	49.27	78	80.07	800	821.20
19	19.50	49	50.30	79	81.09	900	923.85
20	20.53	50	51.32	80	82.12	1000	1026.50
21	21.56	51	52.35	81	83.15	2000	2053.00
22	22.58	52	53.38	82	84.17	3000	3079.50
23	23.61	53	54.40	83	85.20	4000	4106.00
24	24.64	54	55.43	84	86.23	5000	5132.50
25	25.66	55	56.46	85	87.25	6000	6159.00
26	26.69	56	57.48	86	88.28	7000	7185.50
27	27.72	57	58.51	87	89.31	8000	8212.00
28	28.74	58	59.54	88	90.33	9000	9238.50
29	29.77	59	60.56	89	91.36	10000	10265.00
30	30.80	60	61.59				

TABLE 3

Equivalents of decimals of the new metric carat in 64ths of the old carat. Computed on the basis—

1 new metric carat=200 milligrams

1 old carat=205.3 milligrams

(All the values between the two connected by each brace are equivalent to the number of 64ths of an old carat given opposite the brace.)

New Metric Carats	Old Carats	New Metric Carats	Old Carats	New Metric Carats	Old Carats	New Metric Carats	Old Carats
0.00_{8}	1/64	0.26_{5}	17/64	0.52_{1}	33/64	0.77_{8}	49/64
0.02_{4}	2/64	0.28_{1}	18/64	0.53_{7}	34/64	0.79_{4}	50/64
0.04_{0}	3/64	0.29_{7}	19/64	0.55_{3}	35/64	0.81_{0}	51/64
0.05_{6}	4/64	0.31_{3}	20/64	0.56_{9}	36/64	0.82_{6}	52/64
0.07_{2}	5/64	0.32_{9}	21/64	0.58_{5}	37/64	0.84_{2}	53/64
0.08_{8}	6/64	0.34_{5}	22/64	0.60_{1}	38/64	0.85_{8}	54/64
0.10_{4}	7/64	0.36_{1}	23/64	0.61_{8}	39/64	0.87_{4}	55/64
0.12_{0}	8/64	0.37_{7}	24/64	0.63_{4}	40/64	0.89_{0}	56/64
0.13_{6}	9/64	0.39_{3}	25/64	0.65_{0}	41/64	0.90_{6}	57/64
0.15_{2}	10/64	0.40_{9}	26/64	0.66_{6}	42/64	0.92_{2}	58/64
0.16_{8}	11/64	0.42_{5}	27/64	0.68_{2}	43/64	0.93_{8}	59/64
0.18_{4}	12/64	0.44_{1}	28/64	0.69_{8}	44/64	0.95_{4}	60/64
0.20_{0}	13/64	0.45_{7}	29/64	0.71_{4}	45/64	0.97_{0}	61/64
0.21_{7}	14/64	0.47_{3}	30/64	0.73_{0}	46/64	0.98_{6}	62/64
0.23_{3}	15/64	0.48_{9}	31/64	0.74_{6}	47/64	1.00_{2}	63/64
0.24_{9}	16/64	0.50_{5}	32/64	0.76_{2}	48/64	1.01_{8}	64/64
0.26_{5}		0.52_{1}		0.77_{8}		1.03_{5}	

TABLE 4

Equivalents of the new metric carats in old metric carats.
Computed on the basis

1 new metric carat==200 milligrams
1 old carat==205.3 milligrams

Sets of weights for the new metric carat may be obtained from your jobbers.

New Metric Carats	Old Carats	New Metric Carats	Old Carats	New Metric Carats	Old Carats	New Metric Carats	Old Carats
1	62/64	31	30 13/64	61	59 27/64	90	87 43/64
2	1 61/64	32	31 11/64	62	60 26/64	91	88 42/64
3	2 59/64	33	32 9/64	63	61 24/64	92	89 40/64
4	3 57/64	34	33 8/64	64	62 22/64	93	90 38/64
5	4 56/64	35	34 6/64	65	63 21/64	94	91 37/64
6	5 54/64	36	35 5/64	66	64 19/64	95	92 35/64
7	6 52/64	37	36 3/64	67	65 17/64	96	93 33/64
8	7 51/64	38	37 1/64	68	66 16/64	97	94 32/64
9	8 49/64	39	38	69	67 14/64	98	95 30/64
10	9 47/64	40	38 62/64	70	68 12/64	99	96 28/64
11	10 46/64	41	39 60/64	71	69 11/64	100	97 27/64
12	11 44/64	42	40 59/64	72	70 9/64	200	194 54/64
13	12 43/64	43	41 57/64	73	71 7/64	300	292 16/64
14	13 41/64	44	42 55/64	74	72 6/64	400	389 43/64
15	14 39/64	45	43 54/64	75	73 4/64	500	487 6/64
16	15 38/64	46	44 52/64	76	74 2/64	600	584 33/64
17	16 36/64	47	45 50/64	77	75 1/64	700	681 59/64
18	17 34/64	48	46 49/64	78	75 63/64	800	779 22/64
19	18 33/64	49	47 47/64	79	76 61/64	900	876 49/64
20	19 31/64	50	48 45/64	80	77 60/64	1000	974 12/64
21	20 29/64	51	49 44/64	81	78 58/64	2000	1948 24/64
22	21 28/64	52	50 42/64	82	79 57/64	3000	2922 35/64
23	22 26/64	53	51 40/64	83	80 55/64	4000	3896 47/64
24	23 24/64	54	52 39/64	84	81 53/64	5000	4870 59/64
25	24 23/64	55	53 37/64	85	82 52/64	6000	5845 7/64
26	25 21/64	56	54 35/64	86	83 50/64	7000	6819 18/64
27	26 19/64	57	55 34/64	87	84 48/64	8000	7793 30/64
28	27 18/64	58	56 32/64	88	85 47/64	9000	8767 42/64
29	28 16/64	59	57 31/64	89	86 45/64	10000	9741 54/64
30	29 14/64	60	58 29/64				